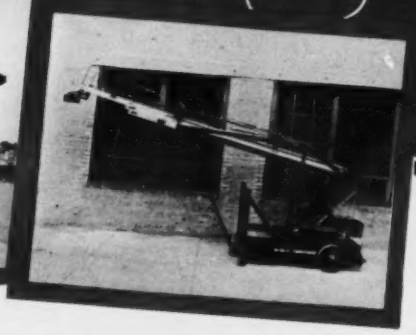
Electrical World

JULY 10, 1943

AIR BLAST RAISES RATING OF PHASE SHIFTER

"Murray" – the modern STANDARD in maintenance ladders!



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These maintenance units make overhead servicing *so* fast and easy that light output is kept at maximum.

The chief advantage of these Murray Crows'nests is that they make overhead, out-of-the-way lights, unit heaters and sprinkler heads, easily accessible, without disturbing men, machines or production schedules in the slightest.

All the many important plants which have taken on Murray Crows'nests, wonder how any plant ever got along without them. Fill in the coupon and mail—we'll propose a unit suiting your particular needs. Metropolitan Device Corporation, Brooklyn 16, N. Y.

Courtesy "Magazine of Light" General Electric Co.

Courtesy "Magazine of Light" General Electric Co.

Metropolitan Device Corp.
Brooklyn 16, N. Y.

Send data (without obligation) on Murray Crows'nest suitable for our requirements. Ladder must reach feet high, and extend feet side-ways. Aisle width is feet.

Name and Title_____

Company_____

Address_____

Murray crows'nest

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

July 10, 1943 — Vol. 120, No. 2

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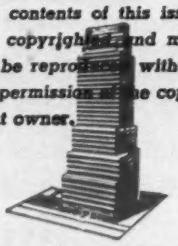

CHANGE OF ADDRESS

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330 West 42nd Street, New York, 18, N. Y.
Director of Circulation:

Please change my address on Electrical World

From .....

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To .....

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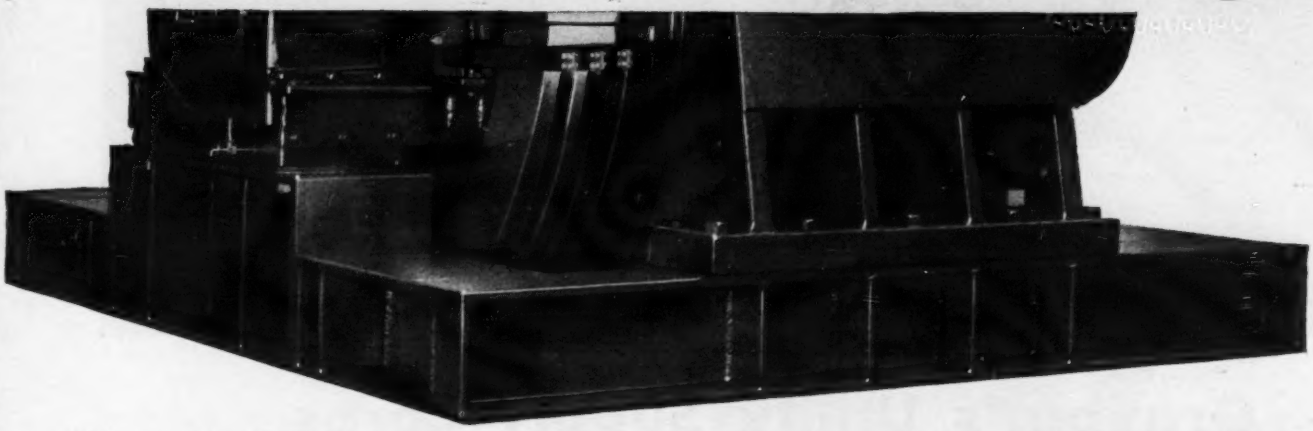
Signed .....

We said *they are tough!*



One reason these big Elliott motors have earned a reputation for exceptional stamina, is because they are so often found in specially difficult drives, in unusual applications. Elliott engineers have for years specialized on motor design for this type of service, and will have something of value to suggest, should you be in the market for motors of this character.

Remember PEARL HARBOR?

WELL . . . when the job of rehabilitation was at its frenzied height, we received a wire from there identifying a certain Elliott motor installed on a dredge, and asking its absolute, maximum rating, as it was running hot at 6000 hp.

The rating of that motor is 2500 hp!

There it was, groaning along at almost two and a half times its rated capacity, handling some pumping job of dire emergency, helping to bring order out of chaos, to lighten as far as it could one of the black pages in American history.

Whether it be men or motors, times of crisis and bitter need bring out those reserves of strength and fortitude which indicate exceptional character. We are glad when Elliott motors are put to this test.

L-743

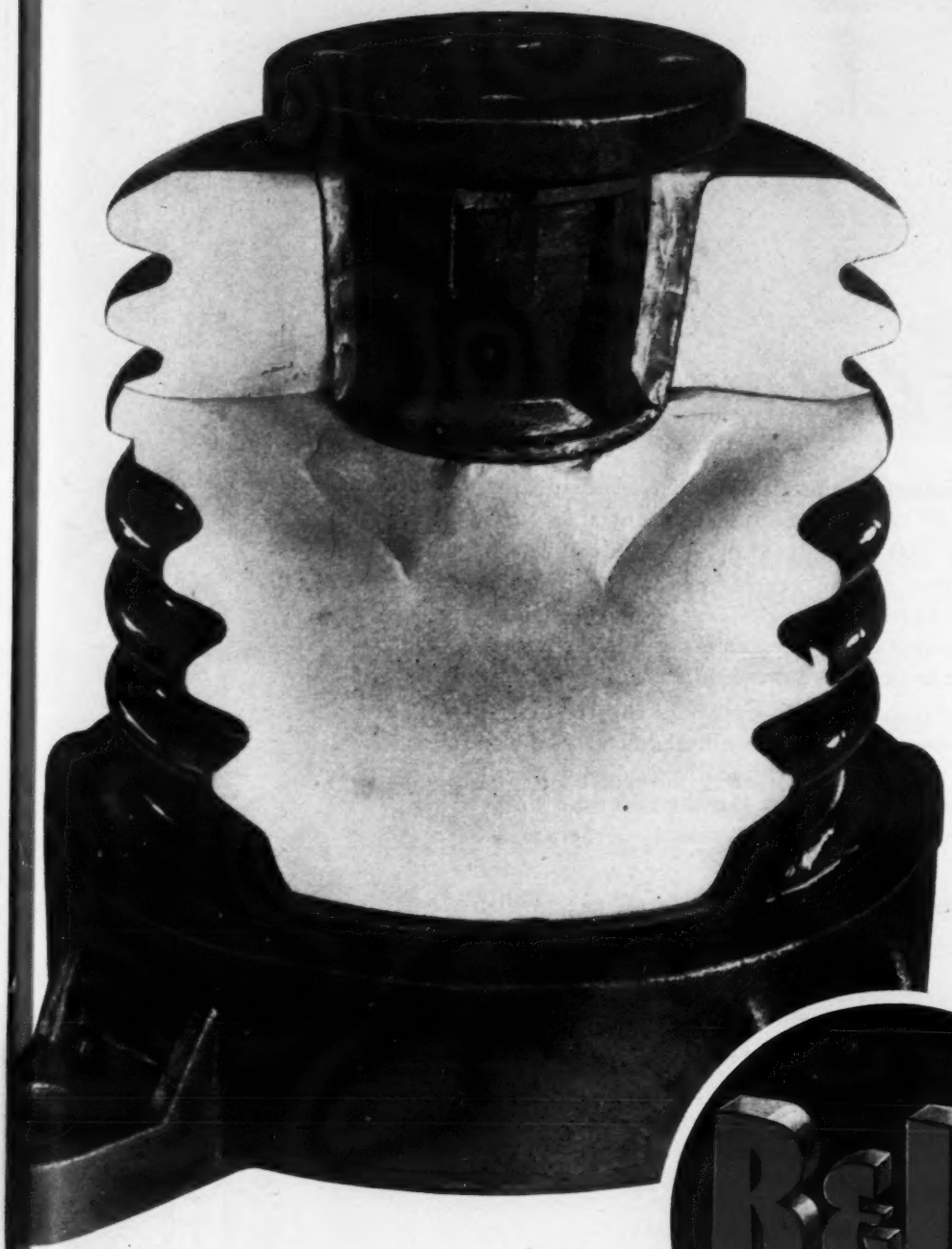
The Army-Navy "E" has been awarded to both the Jeannette and the Ridgway plants of Elliott Company.

ELLIOTT MOTORS

ELECTRIC POWER DEPARTMENT
RIDGWAY, PA.
DISTRICT OFFICES IN PRINCIPAL CITIES

CHECK the FACTS

1. Maximum strength, with proper use of restricted materials.
2. Shrink-fit assembly, with special alloy, of hardware and unsanded porcelain—eliminates spot loading and provides resilient construction.
3. Interchangeable with any bus or switch hardware of equal capacity.
4. Jig set—provides centered and paralleled top and bottom hardware.
5. Special bases can be furnished for any mounting. Hardware can be furnished for bus or switch construction—Class A, B or D.



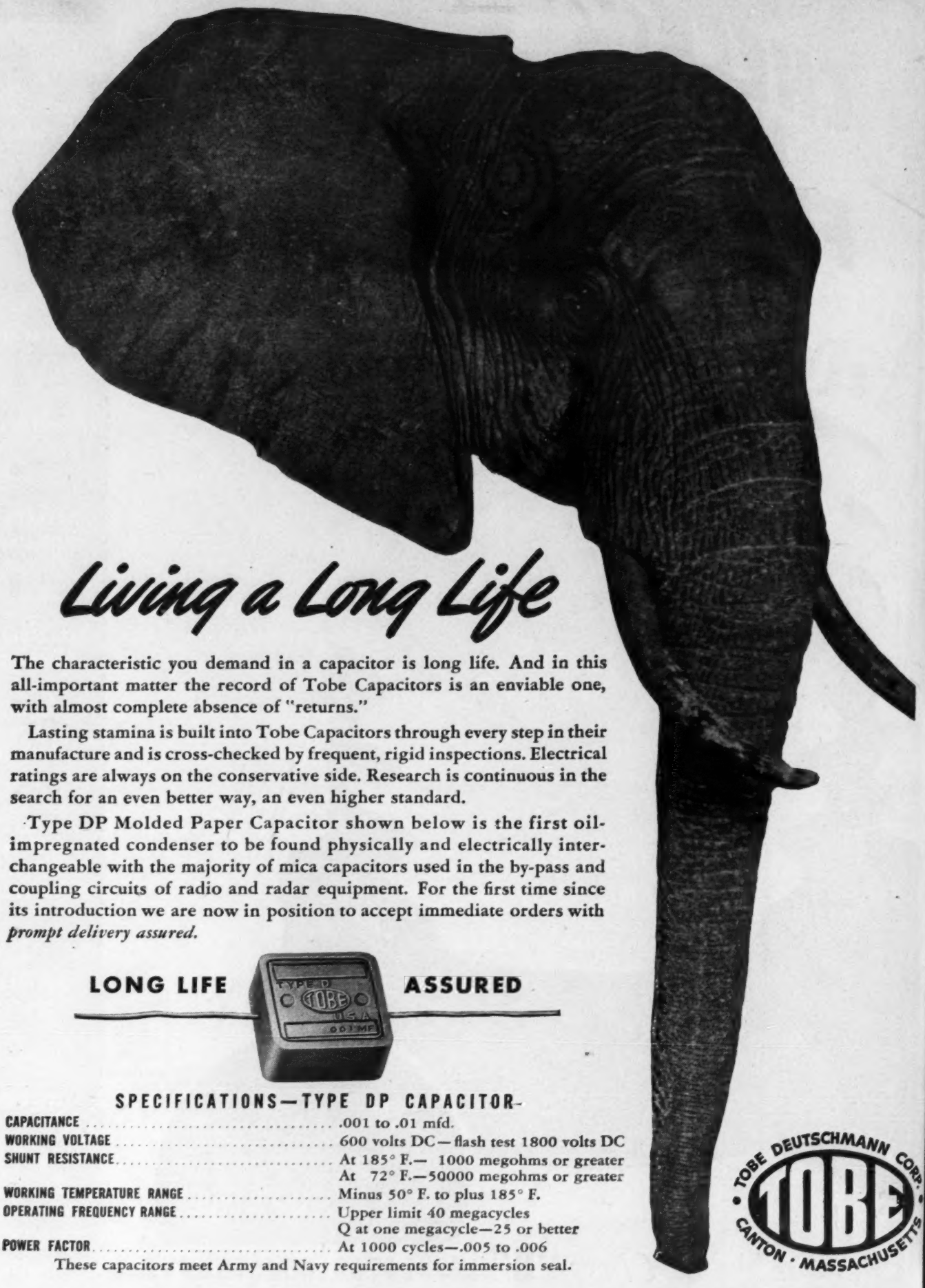
Class **"B"** **INSULATOR CONSTRUCTION**

The Check list

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- AIR BREAK SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

R&IE

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.



Living a Long Life

The characteristic you demand in a capacitor is long life. And in this all-important matter the record of Tobe Capacitors is an enviable one, with almost complete absence of "returns."

Lasting stamina is built into Tobe Capacitors through every step in their manufacture and is cross-checked by frequent, rigid inspections. Electrical ratings are always on the conservative side. Research is continuous in the search for an even better way, an even higher standard.

Type DP Molded Paper Capacitor shown below is the first oil-impregnated condenser to be found physically and electrically interchangeable with the majority of mica capacitors used in the by-pass and coupling circuits of radio and radar equipment. For the first time since its introduction we are now in position to accept immediate orders with *prompt delivery assured.*

LONG LIFE **ASSURED**

SPECIFICATIONS—TYPE DP CAPACITOR

CAPACITANCE	.001 to .01 mfd.
WORKING VOLTAGE	600 volts DC—flash test 1800 volts DC
SHUNT RESISTANCE	At 185° F.— 1000 megohms or greater At 72° F.—50000 megohms or greater
WORKING TEMPERATURE RANGE	Minus 50° F. to plus 185° F.
OPERATING FREQUENCY RANGE	Upper limit 40 megacycles Q at one megacycle—25 or better
POWER FACTOR	At 1000 cycles—.005 to .006

These capacitors meet Army and Navy requirements for immersion seal.

TOBE DEUTSCHMANN CORP. • TOBE • CANTON · MASSACHUSETTS

A SMALL PART IN VICTORY TODAY—A BIG PART IN INDUSTRY TOMORROW

Allis-Chalmers Dry-Type Transformers Can be Installed Right at Load Centers!

TO SPEED up production, that infra-red dryer was rushed into the set-up of a midwest war plant.

Power problem? Simple! A bank of three Allis-Chalmers Dry-Type Transformers was quickly installed *right by* the dryer!

You can put these modern units almost *anywhere* — on posts or beams — saving valuable floor space. No danger of oil leaks. No need for fire-proof vaults.

Load center location means less voltage regulation, lower line losses, improved motor performance . . . *big savings on heavy secondary copper!*

And with no insulating liquid to test, filter, or change, maintenance is at a minimum!

It's smart buying to get the full story on Allis-Chalmers Dry-Type Transformers from your nearby A-C district office. Or write ALLIS-CHALMERS, MILWAUKEE.

A 1610

SPOTLIGHT FEATURES

NO FIREPROOF VAULTS!

NO INSULATING LIQUID TO FILTER!

NO LOST FLOOR SPACE!

NO LEAKS!

NO LONG HEAVY SECONDARY RUNS!

ALLIS-CHALMERS Dry-Type Transformers

AC WE WORK FOR VICTORY WE PLAN FOR PEACE

AT LAST!

A New Sleeving— Flexible as String and Non-Fraying

THIS – NOT THIS

AFTER many experiments, we have developed a super-flexible Fiberglas Sleeving which will not fray.

This sleeving is made by an entirely new, recently-discovered process. Formerly, to prevent excessive fraying, it was necessary to saturate the sleeving, sometimes to a degree where stiffness became objectionable. The new BH Fiberglas Sleeving is as limp and flexible as string—you could tie any kind of a knot with it—yet the severest handling will produce only the merest fuzz at the end.

NON-FRAYING • FLEXIBLE • HEAT-RESISTANT
NON-INFLAMMABLE • WATER-RESISTANT
NON-CRYSTALLIZING at LOW TEMPERATURES

The new BH Fiberglas Sleeving is woven from the choicest continuous-filament Fiberglas yarns. It possesses extremely high dielectric strength, is water-resistant and, like all BH Sleeving and Tubing—is non-inflammable.

All sizes, from No. 20 to 5/8", inclusive, are available. Write for samples of this radically new and different sleeving today—in the sizes you desire. Seeing is believing! Bentley, Harris Manufacturing Co., Dept. W, Conshohocken, Pa.

BH PRODUCTS

NON-BURNING IMPREGNATED MAGNETO TUBING • NON-BURNING FLEXIBLE VARNISHED TUBING • SATURATED AND NON-SATURATED SLEEVING

BENTLEY, HARRIS MANUFACTURING CO.
Conshohocken, Penna.

Why hope FOR DEFINITE STRENGTH when you can get it

. . . BY SPECIFYING O-B SUSPENSION INSULATORS

If you had a piece of one-inch rope, could you make it stronger by splicing on a length of three-inch? Obviously not! But that is the reasoning behind *average strength* ratings of suspension insulators...Mathematically, a few units that are unnecessarily strong compensate for those that may be critically weak, but in practice the stronger ones won't help the others hold up your transmission lines. Every unit in a string of suspension insulators is "on its own". Therefore, every O-B insulator is individually rated for strength of the minimum unit, and that rating is permanently marked on the cap. Not one O-B unit will fall below this value. Practically all will be above it...When you insulate with O-B, the sound engineering that went into design of the whole line need not give way to mere hope that no sub-strength units are in your suspension strings...Specify O-B and get the kind of strength that *counts*, because you can *count* on it.

2403-H

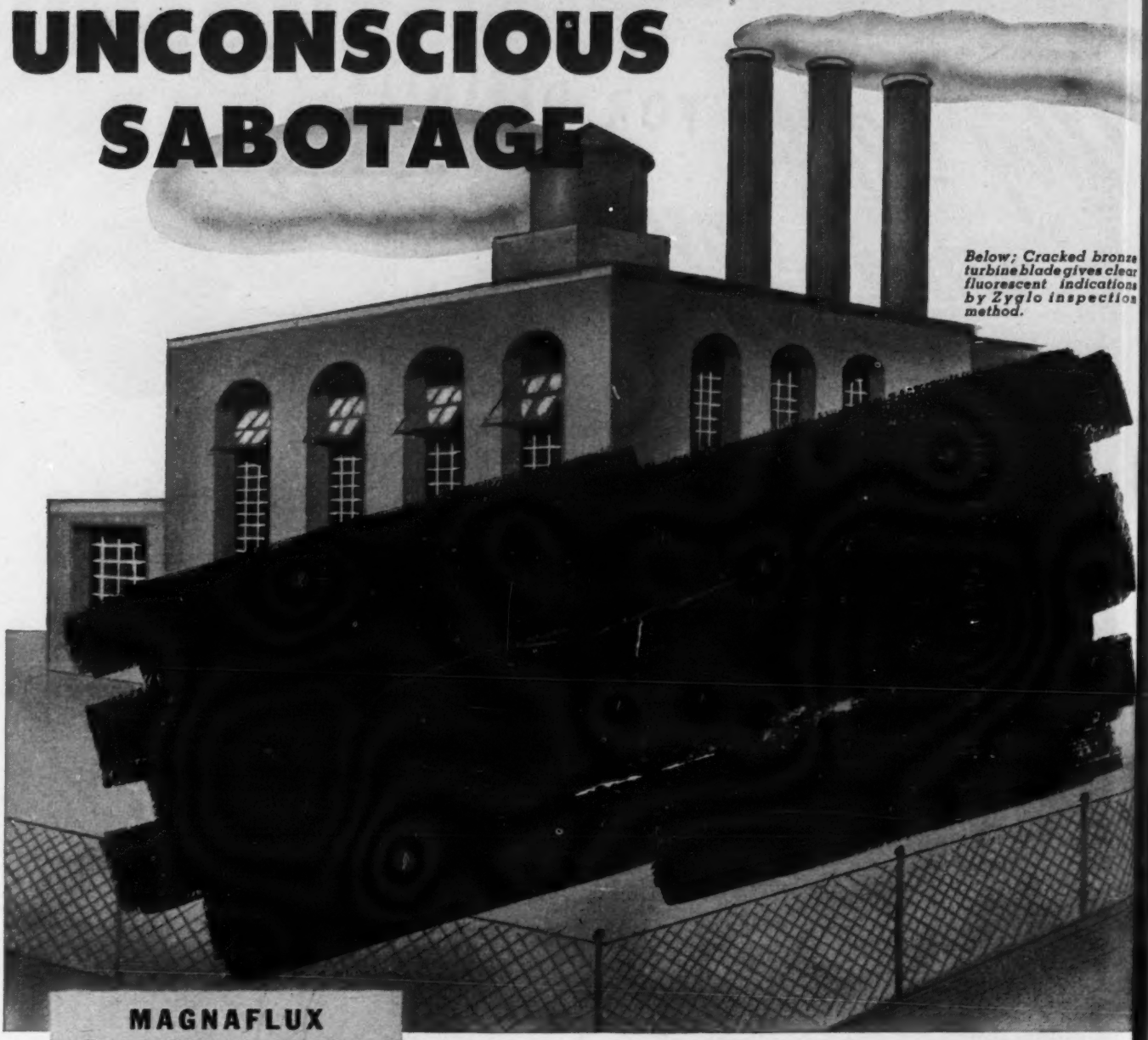
Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

VICTORY
BUY UNITED STATES WAR BONDS AND STAMPS

UNCONSCIOUS SABOTAGE



Below; Cracked bronze turbine blade gives clear fluorescent indications by Zyglo inspection method.

MAGNAFLUX
Power Plant Inspection Service

3 METHODS

MAGNAFLUX
Magnetic Particle Inspection

MAGNAGLO
Fluorescent Magnetic Particle Inspection

ZYGLO
Fluorescent Non-Magnetic Inspection

Inspect . . . Detect . . . Protect Against It

Incurring damage to power plant equipment *by not being able to detect the flaws* is certainly not a guilty act. But damage which develops from undetected fatigue cracks nevertheless ranks with sabotage in today's world crisis—stops an entire plant, often many plants.

The improved inspection methods developed by Magnaflux Corporation now enable power plants to forestall failure in a double sense—not only at an earlier stage than other methods permit, but in a wider range of equipment even than Magnaflux* Methods permitted formerly. Non-magnetic materials can now be inspected as well as magnetic, and both types of inspection can be performed in dark inaccessible places with better practical results.

Three methods—Magnaflux, Magnaglo and Zyglo—now in daily use in other industries have been combined as Magnaflux Power Plant Inspection Service. Through Magnaflux Corporation's branches and field representatives, a service contract can be made for periodic inspections at a rate based on horsepower and types of equipment. Scheduling of service to coincide with tear-down and overhaul work can be arranged.

All interested companies are urged to write for the fullest details of the service now.

*Magnaflux—the Trade Name of the Magnaflux Corporation applied to its equipment, materials and methods for magnetic particle inspection.

MAGNAFLUX CORPORATION
5916 Northwest Highway, Chicago
NEW YORK • DETROIT • DALLAS • LOS ANGELES

Properly Engineered

from Crossarm to Conductor

O-B HARDWARE AND INSULATORS ARE THE ONLY SUCH COMBINATION MANUFACTURED BY A SINGLE ORGANIZATION

This is worth a lot to you, and we'll tell you why...O-B is the only supplier to the electrical industry that offers you this combination: (1) Manufacture of *all* hardware in its own plant under specialized, controlled conditions. (2) Complete freedom of choice between casting and forging, depending wholly upon its suitability for the work. (3) Production of every kind of high-voltage insulator and assembly of all porcelain with metal parts. (4) Adequate facilities to test any piece or any combination mechanically and electrically...From all of this comes a well rounded-out attitude in hardware design, backed by a thorough knowledge of its relation to the broad transmission picture. O-B engineering starts at the crossarm and ends at the conductor. It doesn't over-emphasize any specialty...With unlimited choice of material and wide experience, O-B designers have turned to malleable iron as the most satisfactory metal for transmission hardware. Some of the reasons for this choice are listed here. They are good reasons for *your* choice of O-B hardware for greatest reliability.

O-B MALLEABLE IRON HARDWARE IS TODAY'S BEST BUY BECAUSE--

Malleable iron is shaped by casting, allowing correct functional design to be incorporated with the fewest compromises brought about by manufacturing restrictions.

Malleable iron is, fortunately, the least critical metal in the ferrous group--easiest to obtain for approved use.

Malleable iron has a good, practical ratio of strength to weight--O-B hardware is amply strong for the heaviest service.

Malleable iron, upon rusting, forms a tenacious, indestructible coating of iron-oxide that acts as a perfect protection for the metal underneath--it is unique in this valuable respect.

Malleable iron is extremely ductile--will withstand severe twisting and bending without failure.

2424-H

Ohio Brass

MANSFIELD, OHIO

Canadian Ohio Brass Company, Ltd., Niagara Falls, Ontario

★ KEEP BUYING WAR BONDS ★

EASY TO ASSEMBLE METAL PARTS ON

ILLINOIS POTHEAD PORCELAIN

★ The top and bottom surfaces of ILLINOIS Pothead Porcelain are absolutely parallel. End surfaces are ground by special machinery when required.

Perfect assembly, so important to the pothead manufacturer, is assured—a feature which increases production efficiency.

Another step in the manufacture of ILLINOIS Pothead Porcelain is that of gaining exact dimensions—this is accomplished through profile control which makes possible uniform contour as well as accurate dimensions.

HIGH
DIELECTRIC STRENGTH

HIGH
MECHANICAL STRENGTH

EXACT DIMENSIONS
AND UNIFORMITY

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB **ILLINOIS**

HOW TO SOLVE

Operating Problems with *Correct Lubrication*

Prevent Blow-by & Resist Wear!

OUR ARTIST has cut away part of the top of that Diesel piston and put a spotlight on it. For, right there, Gargoyle D.T.E. Oils Nos. 1-5 can help prevent a lot of operating trouble.

THE RINGS STAY FREE TO SEAL AGAINST BLOW-BY! At ring-zone temperatures, even under full-load operation, these oils resist the formation of hard carbon and gummy deposits which get behind those rings and cause them to stick.

WEAR IS MINIMIZED! In addition, these oils minimize wear by forming tenacious films that resist rupture and the wiping action of piston rings which are forced against the cylinder walls by high gas pressure.

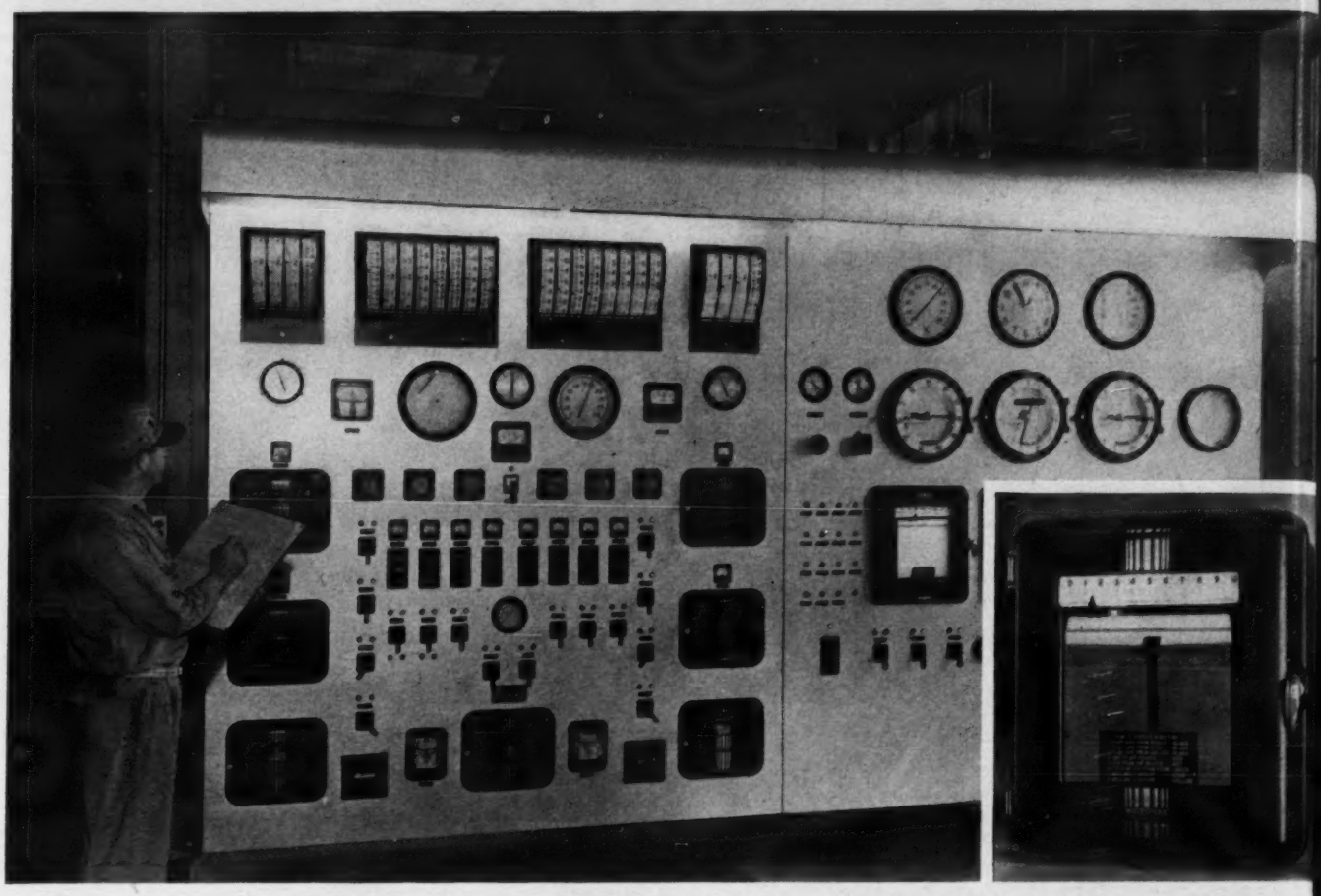
• • •

For long, trouble-free operating life and maximum engine performance in large and medium-size Diesels, be sure you are using a Gargoyle D.T.E. Oil No. 1 to 5.

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Magnolia Petroleum Company • General Petroleum Corporation of California

Call in SOCONY-VACUUM



A central station arranged its L&N boiler-control equipment as shown here. Included are Metermax Combustion Control, Micromax Round-chart Recorders for superheated steam, steam purity and CO_2, and a Micromax Strip-chart Recorder for air, gas and water temperatures.

Micromax Recorder with tear-d device for removal of day's recor

MANPOWER GOES FURTHER
With Instruments & Controls by L&N

Supplied one at a time, or in completely-assembled panels, L&N's dependable, fully-automatic instruments and controllers are helping many a power plant which must stretch its remaining manpower. Typical groups of equipment are shown here.

Micromax Flow Recorder. For accurate determination of steam and water flow. The meter-body is the revolutionary, highly precise Centrimax (centrifugal-force) machine. Integrating and recording are separate, independent functions; neither affects the other. Integration is on the Recorder's counter; rate-of-flow is shown on record in typically thorough, visible, finely-detailed Micromax fashion. Recorder may be Strip-chart or Round-chart. For further information, see Catalog N-28-160, 1942 edition.

Micromax Temperature Recorders. Multiple point instruments supplying multicolor (or single-color) records of temperatures of steam, gas, air, water, from any points at which thermocouples or Thermohms (resistance-thermome ter bulbs) can be located. Records are extremely legible Instruments may be equipped for automatic control o superheat. For further information, write us.

Micromax CO_2 Recorder. The simple, accurate, sensi tive equipment which requires hardly more attention tha does a pyrometer. Can be either a guide to manual adjust ment of combustion, or can automatically operate fuel-ai ratio setting of Metermax Combustion Control. Fo further information, write us, or see Catalog N-91-163 1941 edition.

Metermax Combustion Control. For helping boiler fur naces meet any load conditions, without sacrifice of effi ciency. Combines the sensitivity of electric control wit the simplicity of pneumatic, to form equipment of out standing dependability for medium and large plants. Fo further information, write us.

Jrl Ad N-163(9a)

A Slogan For All Americans

LEEDS & NORTHRUP COMPANY, 4938 STENTON AVE., PHILA., PA

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACE

Tough JOBS DEMAND *Tough* TRUCKS

50 FWDs

Non-Stop, Heavy Duty Service, 24 Hours a Day

Conquer

ALCAN HIGHWAY PROBLEMS!

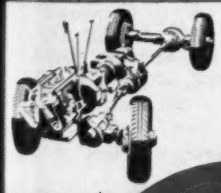
Jobs don't come tougher for trucks than the building and operation of the 1600-mile ALCAN Highway. Through Canadian mountain wilderness, muskeg and swamp, FWD's have conquered every phase of this tough job for trucks.

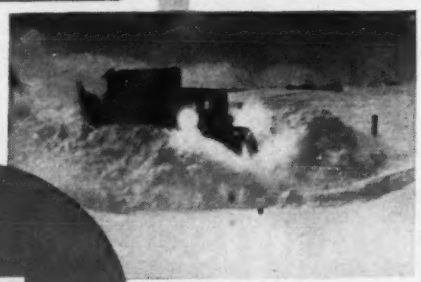
FWD's were in on the construction work . . . hundreds now operate as military cargo trucks . . . others, with heavy snowplows, are relied upon for snow removal service . . . many, mounted with equipment for road building, maintenance, telephone, light and power line construction, are proving their versatility and all-'round ability to conquer these toughest of jobs, on non-stop, 24-hour-a-day schedules, every day!

Whatever the iob may be...whether the "objectives" are military or commercial . . . rugged FWD's have the power and stamina to stand the most punishing service.

THE FOUR WHEEL DRIVE AUTO CO.
CLINTONVILLE, WISCONSIN
Canadian Factory: Kitchener, Ontario
(The Oldest and Original Exclusive Builders of Four-Wheel-Drive Trucks)

True Four-Wheel-Drive Principle with Center ...rential SAVES Tires—Gas—Oil—Replacements





FWD TRUCKS

COMMERCIAL

CONSTRUCTION

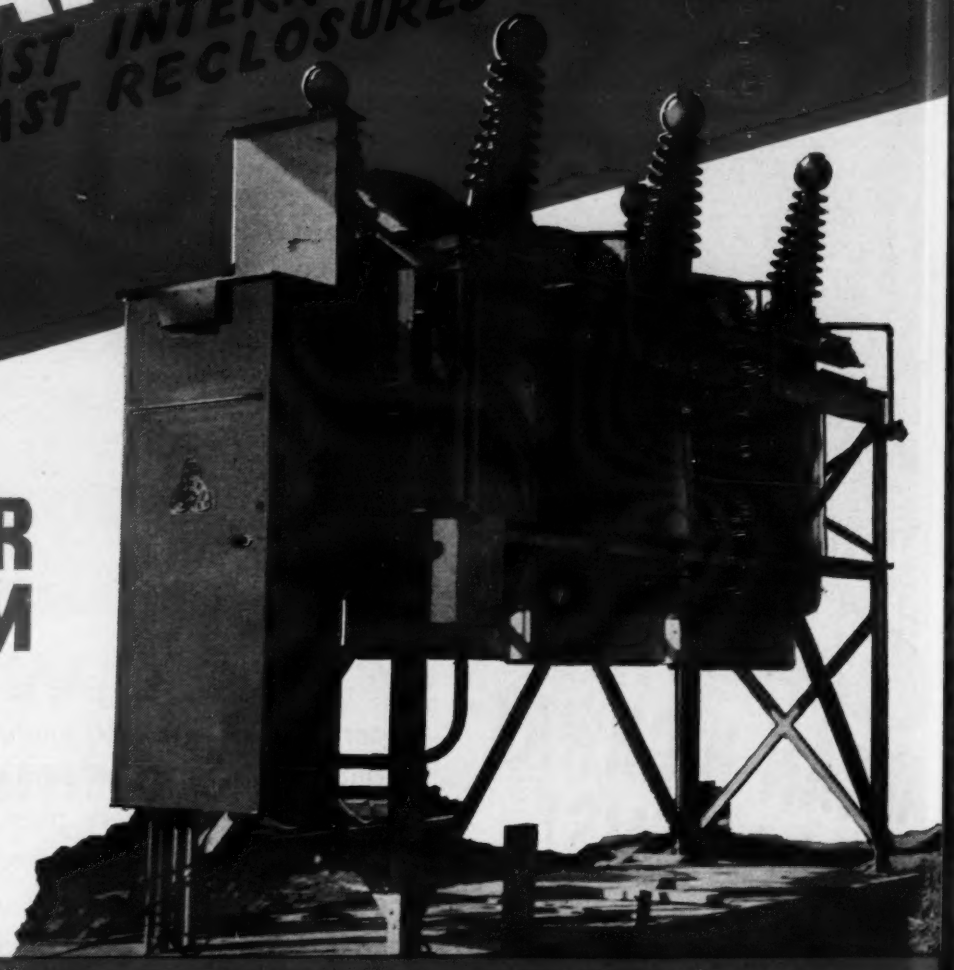
UTILITIES

OIL FIELDS

MILITARY

What Up-To-Date BREAKERS NEED

for FAST INTERRUPTIONS and FAST RECLOSURES . . . .



THE MOTOR MECHANISM ON

Pacific Electric Breakers Assures Reliability and Low Maintenance

INSTALLATION VIEW OF TYPE KDE-42, 69-KV. WITH TYPE ME-2 MOTOR MECHANISM

The prime mover of a breaker must be fast and reliable.

Years of field service have proved that the Pacific Electric Motor Mechanism stands out in speed, reliability and low upkeep for actuating Pacific Electric Breakers.

That's because the motive force for operation results from *spring-stored energy*. The spring is automatically pre-wound by low AC or DC current. There are no expensive station batteries, no short-life rectifiers, no air compressors. You get simplicity of design which further assures positive operation. You have easy manual closing and perfect synchronizing because of the fast, constant operating speed. First reclosures can be either immediate or time-delay, as desired.

The rapid arc extinguishment of the famous Pacific Electric Expulsion Chambers permits fast interruptions and fast reclosures. This saves on oil carbonization and offers utmost safety.

For 37 years the Pacific Electric Mfg. Corporation has specialized in the manufacture of high-voltage switching equipment which has saved maintenance and offers utmost dependability for utilities the nation over. Get all the facts on Pacific Electric Breakers with the years of refinements of the automatic motor-wound spring-actuated Motor Mechanism.

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Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO, 24, CALIF. DUNES HIGHWAY, GARY, INDIAN

Engineering Design
—Creator of America's Mechanized Might

In war, as well as in peace, the design engineer is the vital link between the inventive mind and the mass-production reality

IT IS gratifying and interesting to note that reports of new "secret weapons" not only have reversed their course during the past few months . . . they also have increased in frequency. Once they filled us with dread and misgiving. Today the enemy does the worrying.

Word about the latest new Army weapon reached us as this was being written . . . a 2½ ton truck that performs on water as well as on land with equal efficiency. "The Duck", resembling an overgrown amphibious jeep, is particularly suited to landing operations where docks are lacking. Loaded with 20 fully equipped soldiers or their equivalent in supplies, its propeller runs it ashore. It climbs the beach on its six-wheel drive and continues the trip on land.

This important addition to our "second-front" fighting equipment, coming so closely on the heels of the now famous tank-killing "Bazooka", is one of many history making contributions of American design engineers — the men who transform nebulous ideas into practical realities — the men who make our war machines superior to those of our enemies.

Invasion and eventual victory became a certainty as soon as America's design engineers threw their full effort into the war against aggression. Adapting intricate ordnance designs to mass production, these men developed weapons such as the M-10 destroyer of Rommel's tanks and brought out the new fighting planes and bombers that have won the air superiority that has turned the tide against the Axis. Taking ideas and giving them form, selecting the materials of construction, deciding upon the method of fabrication, adapting the electrical and mechanical parts that power the product, specifying the finish that protects and beautifies it . . . these men are the focal point of American production. Their ingenuity has no parallel. Once they put automobiles on a mass production basis and within the reach of all. Today, after less than three years and with little previous experience in armament design, they have brought America's war weapons to the highest efficiency . . . surpassing Hitler's weapons despite all the vaunted scientific wizardry of the Germans and their ten year start.

At this point it is well to remember that while Germany's military might is traceable to its superiority in armament, many of the basic technological discoveries (including the airplane and the submarine) are the products of American genius. The Germans always have been aware of the military advantages of technological superiority and have forced its expansion with all their might. They knew that mobility and surprise play a decisive role in modern warfare and their design engineers were kept busy, with unique intensity, to achieve unprecedented results in fast-moving, hard-hitting fighting equipment. Our own military and industrial engineers did not go into action until it became certain that we would be involved in the conflict. But even before our country actually embarked on its Preparedness Program they were busily engaged in developing the designs of our war equipment. Tanks, planes, guns, ships and hundreds of other apparatus and machines of war were studied. Carefully selected committees of our national engineering societies were organized under the leadership of the Army Ordnance Department to serve as advisors and consultants in the development of advanced designs of tanks and other motorized equipment of war. The above mentioned "Duck" and the now famous Sherman tank are just two of the many results of these efforts.

After the Preparedness Program had officially been launched and Congress had made its initial appropriation, it was necessary to create the manufacturing blueprints from which the engines of war could be built. Because the designs of the machines of production, as well as the designs of the products themselves, determine the speed and economy with which anything can be manufactured,

This is the thirteenth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

the capacity of our industrial system is dependent, to a considerable extent, upon the ability and ingenuity of American design engineers. Germany's military might was successfully mechanized because Germany, for more than 10 years preceding the war, was riding the wave of a world-wide technological revolution. This revolution was as far-reaching as the advent of the electric motor and the internal combustion engine. It was born of the profusion of inventions and discoveries since the last war. German design engineers took advantage of every one of these.

If we are to defeat our enemies and if we are to continue to play the leading role in the post-war world we must make better use of the new technology than do our enemies. The job is up to American product engineers who already have made tremendous strides in designing the intricate machinery of production and of war equipment. Much remains to be done however.

It has been said that the Germans have not developed one single item that can be classified as basically original, nor are there indications that any so-called "secret weapon" will henceforth be developed by them. Today the Nazis are completely outclassed by the tremendous manpower of engineering brains that is at the disposal of American industry. Although we were faced by the same fundamental problems of shortages in materials, manpower and time, our engineers not only solved these problems quickly and effectively, but they outstripped the enemy by the preponderant weight of talent which we were able to bring to bear upon our problems. As is evidenced by studies of the designs of captured German war equipment, our airplanes are faster, carry heavier loads, have superior protective armor and heavier armament. Our tanks, especially the Shermans, stand unmatched. Our tractor-mounted artillery excels theirs in fighting power. Our automotive vehicles are the envy of the world. Our battleships are supreme. Our signal and detection devices are frustrating all of our enemies' attempts to dominate the seas.

And as we approach the end of the conflict, the pattern of which already has been set, the forces that converted American industry from peace to war-production will again be brought into play, and the product engineer will continue to be the fulcrum. Our post-war industry will grow from his blueprint. Nor will his job be any less urgent, any less responsible, any less sweeping in its effects than were his efforts during the war-preparedness program.

Since the cessation of the manufacture of peace-time goods, many new materials and production techniques have been developed. Plastics, synthetic rubber and magnesium in the field of materials were relatively new and restricted in their uses when war came. So were powder metallurgy, induction heating, electrostatic heating, adhesives for joining metals and compressed resin-impregnated wood. The new possibilities in product design created by the electronic devices and applications developed during the war period virtually stun the imagination and the "atomic revolution" promises to change the entire pattern of manufactu operations.

Never before has there been so much speculation a the future as there is today. Looking forward, who doubt our limitless capacity to continue our indus world leadership?

While no one can predict developments in produc sign in the post-war period, certain it is that they wi so vastly different and so far superior to existing de that they will obsolete most products as we know t today. With engines of vastly superior metals, designe burn 100 octane gasoline and built to a precision ten t greater than that of pre-war engines, our post-war aut biles will give from 40 to 60 miles to the gallon. Tires last from forty to fifty thousand miles. The comfort smoothness with which these cars of tomorrow will g along are undreamed of today. Polaroid windshields eliminate the glare of oncoming headlights and the d will need to give but scant attention to the manipula of his simplified gear shifts.

According to no less an authority than Igor Sikorsky stand on the threshold of a new air age in which the copter will contribute to the greatest prosperity we ever known.

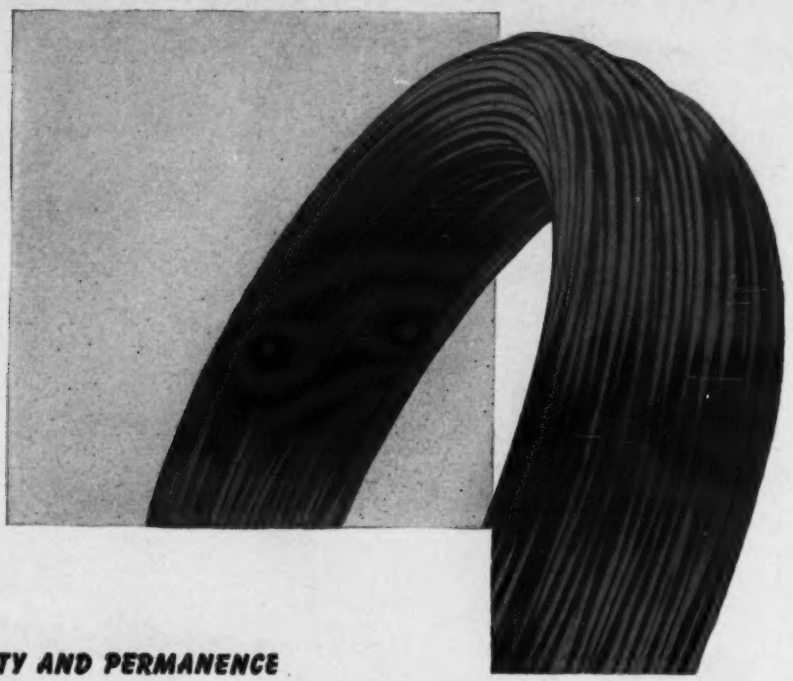
Prophecies are hard to make at a time like this speedy house building seems to be a certainty in the w of tomorrow. Air conditioning, new methods of heat humidifying and drying, promise to be necessities in post-war home. Vacuum sweepers will be much lighter, noisy and easier to manipulate. Washing-machines wil fully automatic and practically free of noise and vibrat Not only will our homes and most of the furnishings b radically new design, but so will the factories and mach that produce them.

Only one factor can prevent the fulfillment of the dr of the product designer. His job is not accomplished night. To convert sound ideas into production bluepr involves a great deal of time and money. The buildin test models is an expensive and tedious procedure. abundance of seed money is required to perfect the p uct, to develop mass-production methods and to bring i fruition as a finished saleable product.

It is the patriotic duty of every industrial leader hasten these developments so that the material ben created by them may speed our progress along the roa abundance.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company,



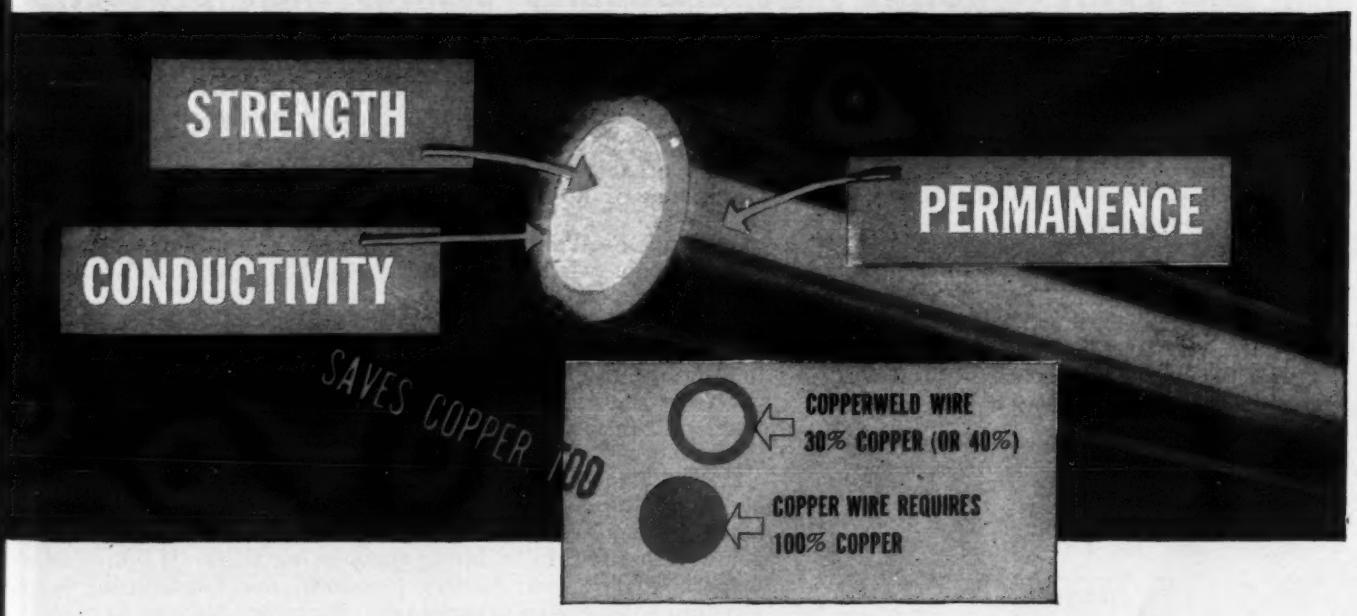
TODAY, MORE THAN EVER,

YOU REQUIRE COPPERWELD'S

Tested STRENGTH, CONDUCTIVITY AND PERMANENCE

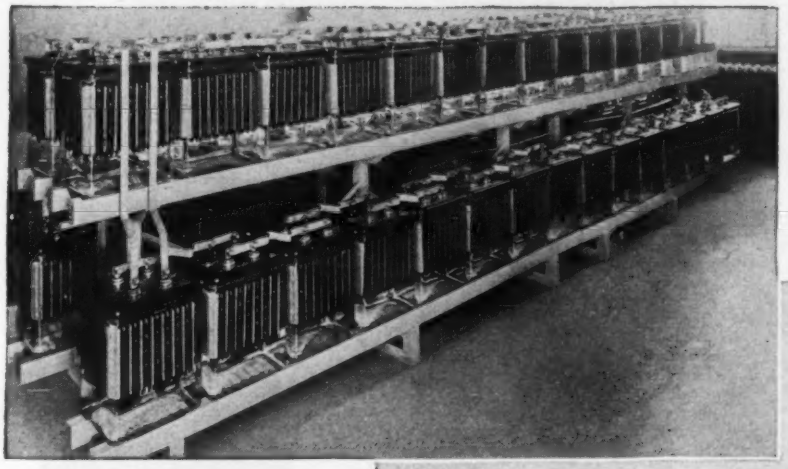
For over a quarter of a century electrical engineers have learned to depend on the copper-steel combination of Copperweld for its inherent strength, conductivity, and permanence. Every coil of wire must pass the following dependability tests: conductivity, breaking strength, elongation, bend, perfection of weld, surface, kink, and required copper thickness.

The steel and the copper combined in Copperweld do many jobs better than either metal could do them alone.



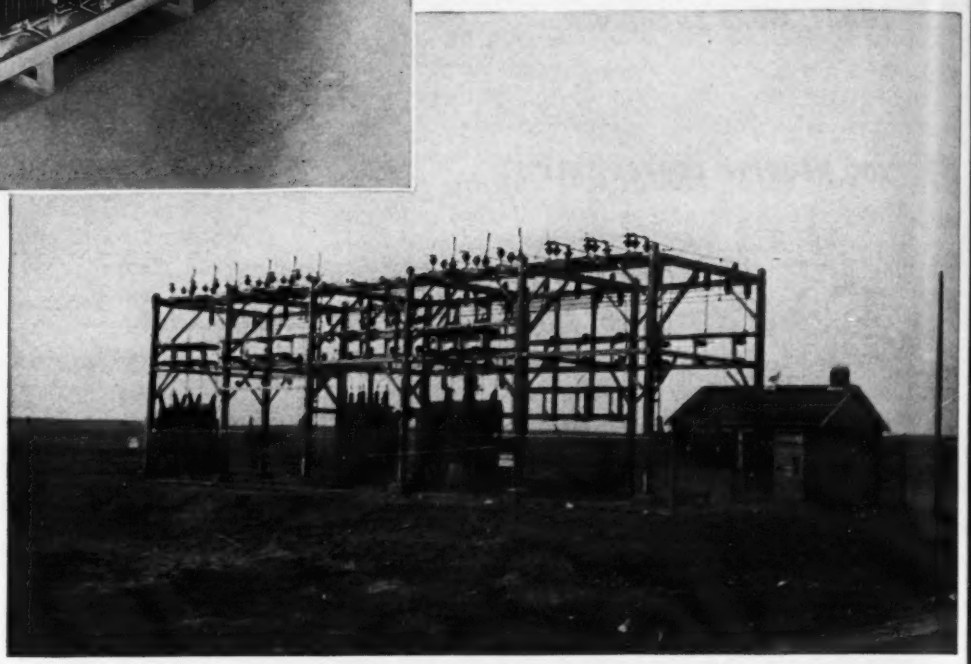
Copperweld Steel Company

GLASSPORT, PENNA.



Left: A typical 60-cell Exide-Chloride Battery for control-bus service, similar to the one mentioned below.

Below: Bowdle Substation of the Dakota Public Service Company, through which power from the Northwestern Public Service Company is interchanged.



Exide
CHLORIDE
BATTERIES

SMALL SUBSTATION OR MAIN POWER PLANT

the Exide-Chloride's dependability assures their protection

TO MAKE YOUR BATTERY LAST—

1. Add approved water at regular intervals. Probably your local water supply is safe to use. If in doubt, ask us.
2. Keep top of battery clean and dry.
3. Check your D.C. control-bus voltmeter to see that it is in calibration. Keep battery fully charged but not overcharged.
4. Keep written records of water additions, voltage, and gravity.

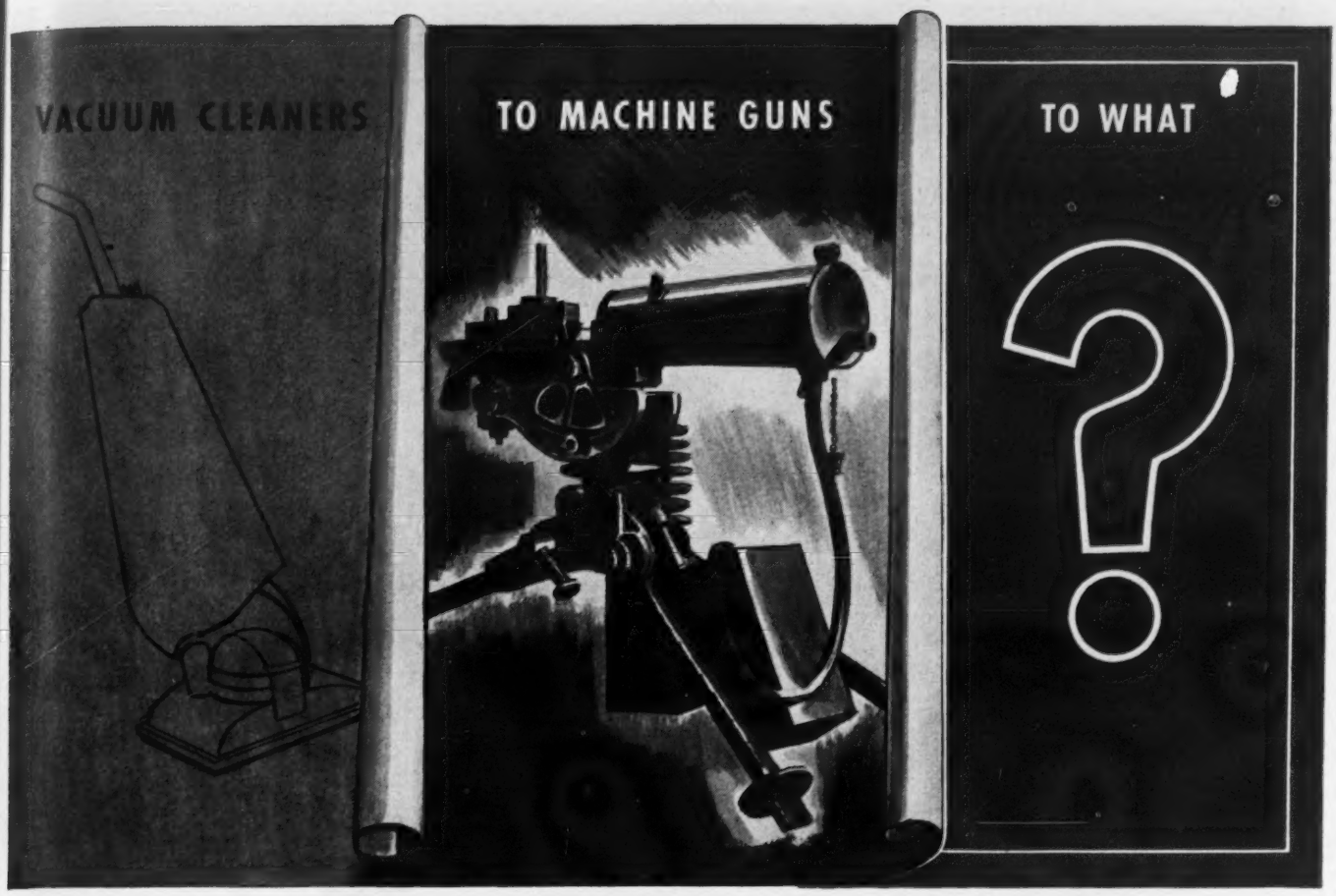
IT isn't large, that substation of the Dakota Public Service Company, located at Bowdle, S. D.—but it *is* important. For the three 38 KV and one 33 KV lines of the Dakota Public Service Company and the Northwestern Public Service Company—two separate organizations—are tied in at this substation, permitting the interchange of 1.5 million KVA per month.

Circuit breakers at this well equipped substation are provided for automatic switching through a 2000 KVA, 38/33 KV stepdown transformer.

Like so many of the nation's largest power plants and generating stations, the Bowdle substation relies upon Exide-Chloride Batteries for the operation of its oil circuit breakers. Here a 60-cell Exide-Chloride, provides ample power for this important task.

The Exide-Chloride Battery's long life and dependability are almost traditional. And while it requires the minimum of maintenance care, every effort should be made to see that this care is administered faithfully during these trying times. If you need any help in solving your battery problems, our Engineering Service Division will be glad to assist you. Write for Bulletin 3225.

THE ELECTRIC STORAGE BATTERY COMPANY
PHILADELPHIA
Exide Batteries of Canada, Limited, Toronto



PLAN YOUR DISTRIBUTION SYSTEM

FOR *Quick Production Shifts*

Future demands on your plant are being decided on battlefields thousands of miles away. To meet them, utmost flexibility in production facilities is the order of the day.

Such flexibility depends to a large extent on your plant distribution system. Is it adaptable to quick changes in the nature, density and location of loads?

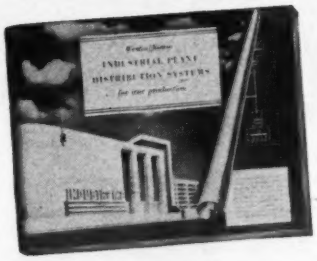
Westinghouse engineers have helped hundreds of war plants choose the "one best" distribution system for their needs. In each case, increased efficiency and protection against sabotage, with the least use of critical materials—have been the governing factors in the selection.

This broad engineering experience is available to you, to help you better meet today's demands, and get set for the swift changes that may come tomorrow.

For prompt action, call our local office. Or send for the helpful booklet below. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. J-94563

UP-TO-DATE FACTS ABOUT DISTRIBUTION SYSTEMS

Keep up to date on latest plant distribution systems. Send for 24-page Booklet, B-3152, which briefly describes different plant distribution systems, and points out the advantages of each.



Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

PLANT DISTRIBUTION SYSTEMS

Design for Lighting—Today and Tomorrow

● Simple and modern in design, the new Sylvania fluorescent fixture meets all normal industrial lighting requirements.

It is another fluorescent first for Sylvania – this all-purpose standardized fixture of the future.

The streamlined top-housing, which weighs less than three pounds, encloses the ballast and protects it from dust.

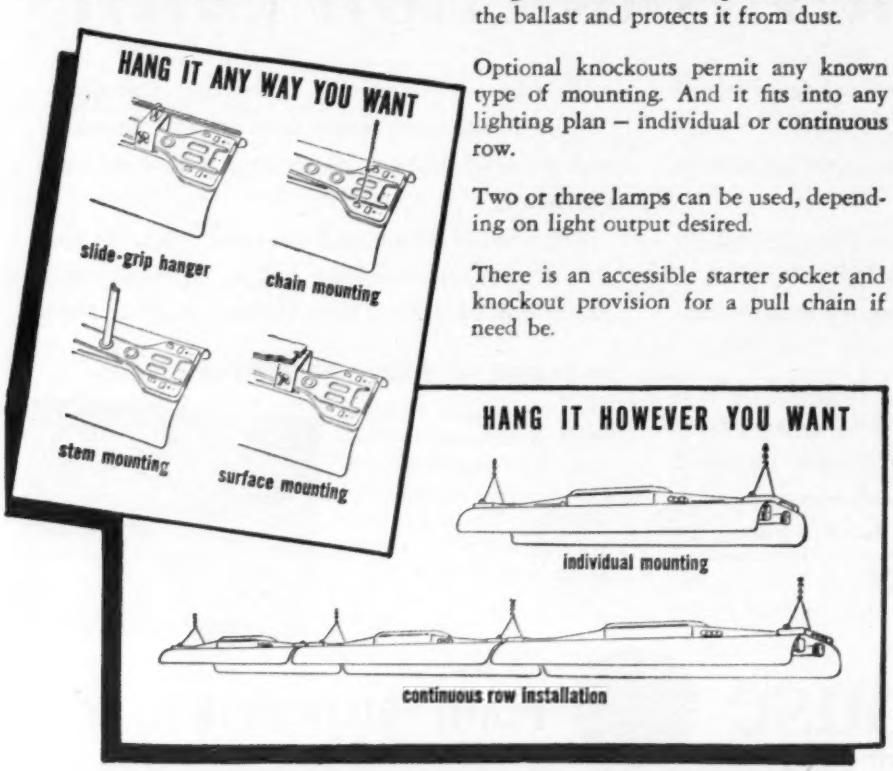
Optional knockouts permit any known type of mounting. And it fits into any lighting plan – individual or continuous row.

Two or three lamps can be used, depending on light output desired.

There is an accessible starter socket and knockout provision for a pull chain if need be.

The fixture is equipped with a light and durable composition reflector that has designed-in efficiency of 86 per cent even higher than that of porcelain enameled metal in conventional contour This reflector stands up under extreme temperature and humidity conditions "Captive Latch" fastenings that require no tools for removal make it easy to service.

The Sylvania fixture of the future is available in 40-watt and 100-watt lengths. It carries Underwriters' Laboratories approval and our own 90-day guarantee. And it meets governmental requirements in every particular. For full details, write Dept. M&F 7.



SYLVANIA

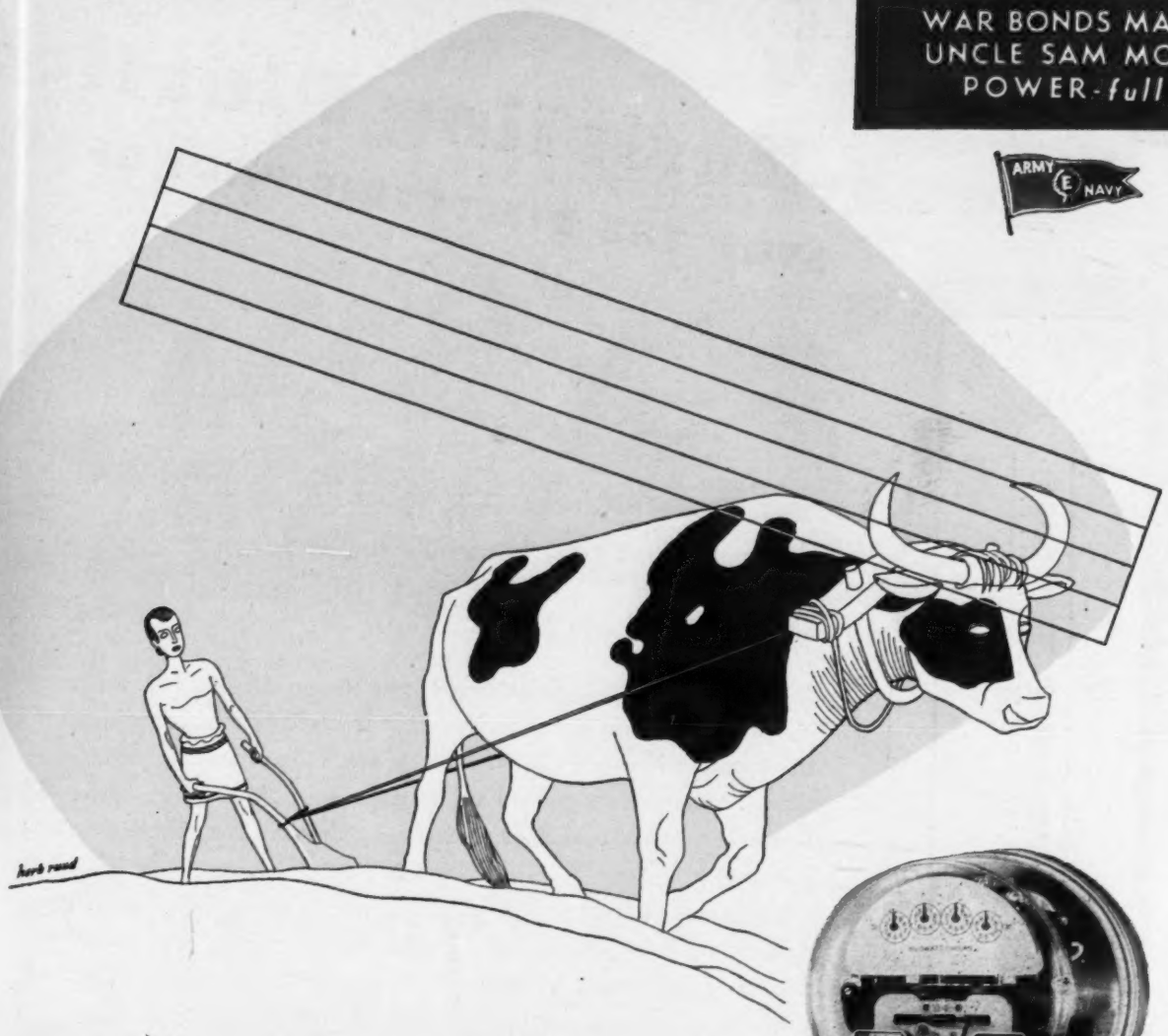
ELECTRIC PRODUCTS INC.

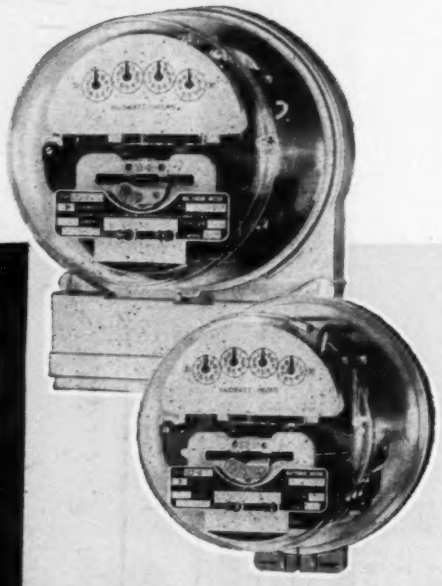
Formerly Hygrade Sylvania Corporation
Ipswich, Mass.

INCANDESCENT LAMPS, FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, RADIO TUBES, ELECTRONIC DEVICES.

WAR BONDS MAKE
UNCLE SAM MORE
POWER-*full*

ARMY E NAVY





"On Measurement is founded the whole progress of man.."

A farmer would be in an unending bedlam of argument with all his neighbors should he re-measure the boundaries of his land by the original way of determining the acre. Here is the way it was done about the time of the fall of the Roman Empire in 476 A.D.: Wielding heavily his willowy sprig, the farmer would push his ox until perforce the ox stopped to catch his breath. Twice up and back they would go, a rood between each furrow, and that was an acre—and that, too, was the conception of standardization. Compare it with today's high standard of measurement of electricity set and met by the electric utilities and the manufacturers of watthour meters.

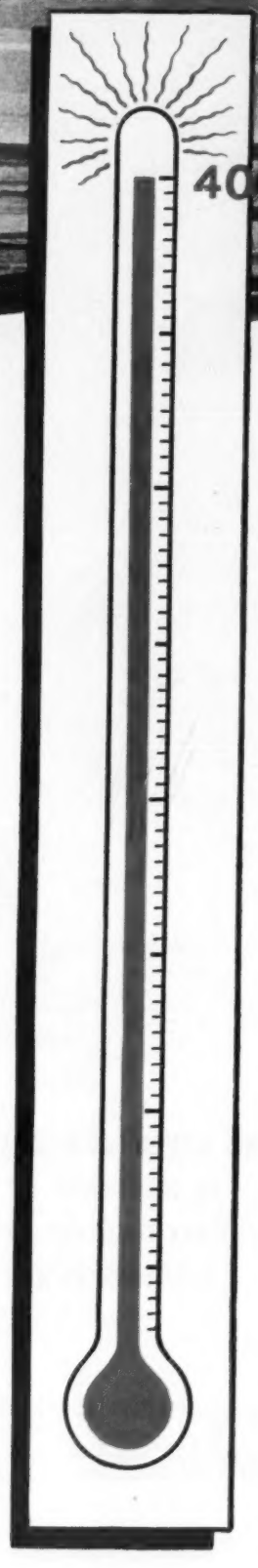
NO OTHER COMMODITY IS MEASURED SO *Accurately* AS ELECTRIC POWER

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

MELMAC

Heat-Resisting Plastics

STOP THE DIELECTRIC "HOT SPOTS"



It gets damn hot inside a tank and an aircraft engine is no slouch when it comes to radiating b.t.u.'s but Melmac* insulating parts have proved they can take it—*up to 400°F!* And Melmac's high dielectric properties . . . dielectric strength and arc resistance are maintained under the most severe service conditions . . . humidity, dust and dirt, temperature changes.

This comparatively new plastic, developed in Cyanamid's Research Laboratories, is available in several types which have been "field tested" in actual service under wartime conditions. One of these types will undoubtedly meet your requirements. All offer unusual dielectric properties, can be mass-produced by conventional molding methods and equipment, are readily available for essential civilian or military needs. Get the full story on this new plastic insulating material by writing for more information. Our technical representatives will be glad to discuss *your* problem with you, give you full cooperation and arrange for tests.

AMERICAN CYANAMID COMPANY
PLASTICS DIVISION
35 ROCKEFELLER PLAZA, NEW YORK, N. Y.

**Reg. U. S. Pat. Off.*

Aircraft engine ignition assembly sleeves and shields are typical applications where the right heat resistance and dielectric strength of Melmac combine to offer a plastic of unusual insulating value. Current wartime demands restrict the commercial use of Melmac to essential needs. Samples for research and testing, however, may be obtained without preference rating.

BEETLE • MELMAC

CYANAMID PLASTICS

IT'S THE *PORCELAIN* THAT INSULATES

PROVING GROUND FOR INSULATORS . .

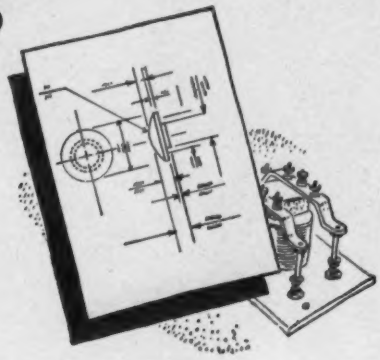
The temperament of the Lapp organization is that of dissatisfaction with existing methods, existing designs. It is this spirit which produced the Line Post and which made necessary the Lapp laboratory, a corner of which is photographed above. No sanctum sanctorum, this laboratory is truly an engineers' workshop, in continuous day-to-day use, testing, discarding, proving new designs. As we learn how to build better insulators, we build them. Meanwhile, we feel secure in our claim that today's Lapp insulators are adequately suited to today's needs, that you can do no better than to insulate your lines with Lapp. Lapp Insulator Co., Inc., Le Roy, N. Y.

ARMY E NAVY

Lapp

Better Porcelain • Better Insulators

The Thirty-First Time Was Also the First!



Not all contact problems yield the answer on the first try. In this case, thirty different combinations of materials were tested; the thirty-first experiment brought the desired solution. And—it was the first time the problem had been licked.

War demands have uncovered marvelous design ingenuity on the part of manufacturers. But new designs breed new material problems and this case was no exception. Indeed, it was plenty tough.

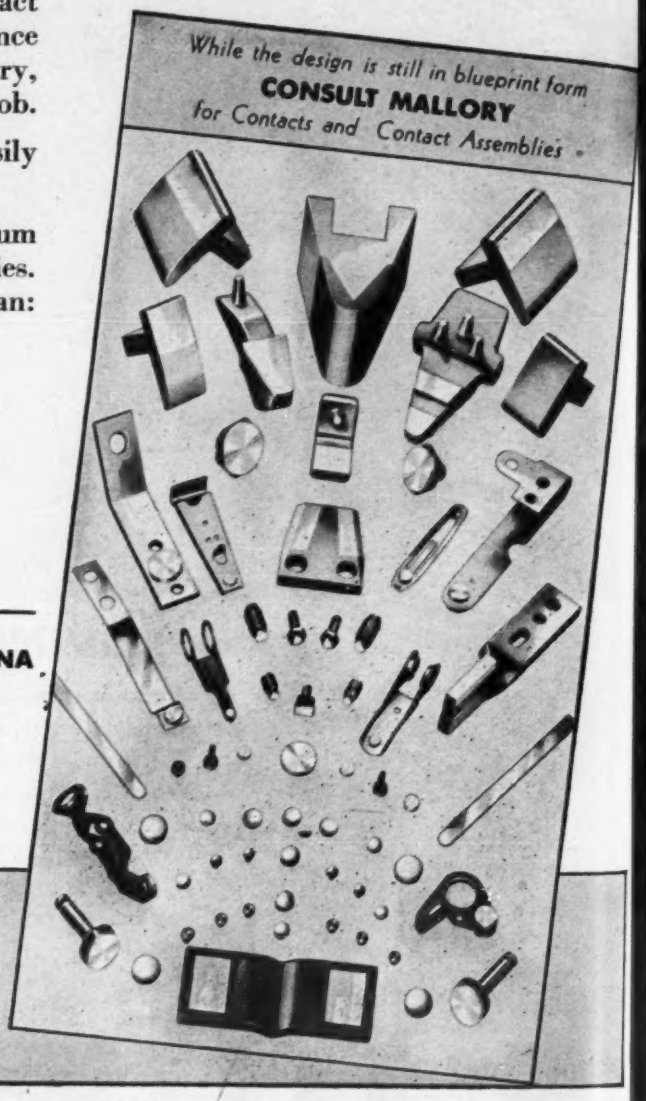
The part was a regulating relay for automotive equipment. The electrical contact specification was the knotty question. In test operation, alloys used produced excessive material transfer, indicating eventual contact failure. But Mallory engineers delved into experience and "know how" to come up, on the thirty-first try, with a Mallory Elkonium that measured up to the job.

Without that experience to draw on, tests might easily have run to a hundred and thirty-one tries!

Mallory aids many a manufacturer to get maximum life from contacts and complete contact assemblies. Specifically, Mallory services, in this connection, can:

1. Suggest contact alloy for any application.
2. Suggest backing materials and methods of assembly.
3. Suggest most suitable operating conditions for the contacts.

Mallory will be glad to cooperate with you.



P. R. MALLORY & CO., Inc., INDIANAPOLIS, INDIANA

Cable Address — PELMALLO

P. R. MALLORY & CO. Inc.

MALLORY

ELECTRICAL CONTACTS AND CONTACT ASSEMBLIES . . . NON FERROUS ALLOYS POWDERED METAL ALLOYS

ROUND-THE-CLOCK SERVICE ASSURED...

...by U.S. in power plant's turbine!

OURS OF OPERATION" alone does not determine the quality of a bine oil. More important are the characteristics of the oil during a en period. Did the oil need purification? Was make-up oil kept to minimum? Did the system and the oil show rust? These are the t of things that determine whether your turbine is operating eco- nically, trouble-free.

One of the many outstanding performance records of Shell Turbo is indicated in the analyses shown at the right. Note how little nge took place even after 24,483 hours of continuous operation. re is definite proof that Shell Turbo Oil has superior oxidation bility. It also prevents rust. Can the turbine oil you now use match ? Draw off a sample and see.

or details on this and other outstanding performances Shell Turbo Oil see the Shell man. Or, write Shell Oil mpany, Inc., Dept. "E," 50 W. 50th St., New York, N.Y., 100 Bush St., San Francisco, Cal.

SHELL TURBO OIL

Currently, the U.S. Navy has first call on Shell's entire production of marine turbine oil

CERTIFIED PROOF OF THE SUPERIOR

*OXIDATION STABILITY

OF SHELL TURBO OIL

156	*Viscosity @ 100° F.*	159
Clear	*Appearance*	*Clear*
.05	*Neutralization No.*	.05
.1	*Saponification No.*	.3

CHARACTERISTICS

Performance record of Shell Turbo Oil in a 6,000 kw. unit of a large utility company in the Southwest.

STARTING TODAY...

ENGINEERS! SEE ALL THESE OUTSTANDING ADVANTAGES!

NEWLY developed Pyrex brand Multiform Glassware is something every engineer should know about. Its general characteristics include low loss factor, high dielectric strength, negligible water absorption and adequate mechanical strength. For example, Multiform glass # 790 meets requirements of U. S. Navy Standard RE-13A-317F. And all Multiform glasses will comply with the A.S.A. American War Standard on Radio Insulation Materials of Low Dielectric Constant.

While rock bottom prices on electrical coil forms are obtained by designing within the specifications on the opposite page, the characteristics of these glasses plus Corning's new fabrication methods makes possible an extremely wide range of shapes and sizes, with close dimensional tolerances. Whatever your electrical insulation requirements it will pay you to investigate Corning Multiform Glass Insulation!

PAY UP TO 47% LESS

FOR ELECTRICAL COIL FORMS

1 DO THIS...DESIGN YOUR FORMS WITHIN THESE 7 MONEY-SAVING SPECIFICATIONS

*1. **OUTSIDE DIAMETERS** between 1 inch and 3 inches.

*2. **WALL THICKNESSES** between 5/32 inch and 9/32 inch.

*3. **LENGTHS** up to 9 inches (with better prices for shorter lengths).

4. **MAXIMUM** of 20 holes for coil forms ¼ inch and 9/32 inch thick with maximum of 4 holes tapped.

5. **MAXIMUM** of 10 holes for coil forms 5/32 inch to 7/32 inch thick with maximum of 2 holes tapped.

6. **MAXIMUM** of 14 grooves to the inch.

*7. **TOLERANCES** on general dimensions ± 2.0%, but not less than ± 0.010 inches.

**Proposed A.S.A. Standards.*

2 DO THIS...

CLIP THIS COUPON TO YOUR BLUEPRINT AND MAIL FOR ACCURATE QUOTATION

Corning Glass Works
Insulation Division, Dept. W-71, Corning, N. Y.

Please send us estimate on coil forms as per attached blueprint and data below:

Quantity.....

When Needed (date).....

Electrical Characteristics.....

.....

Acceptable Revisions.....

.....

Name.....

Company.....

Street.....

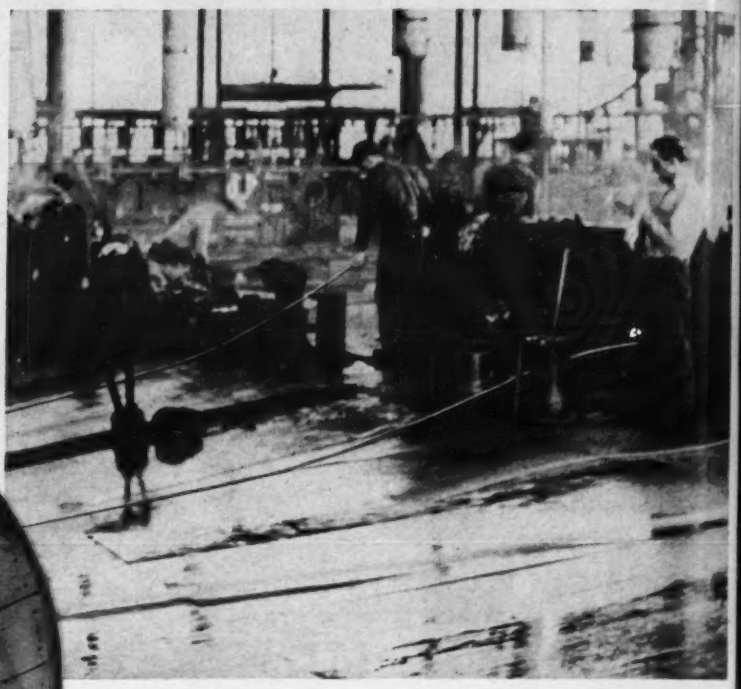
City.....State.....

Pyrex Insulators
BRAND

"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works.

Every Stage in Wire-Making

is Under our Control



Our wire and cable fabrication starts with the copper rods rolled in our own mills . . . From this "base of operations" every step in the manufacture of our various products is carried on under strict engineering supervision. Our standards are exacting and, even in these days of high-speed production, no product leaves this modern plant without the approval of our Inspection Department.

For Wires and Cables of dependable quality, keep in mind

PRODUCTS

- HOT ROLLED COPPER RODS
- BARE AND TINNED COPPER WIRE (In rounds, flats and squares)
- BARE AND TINNED STRAND
- URC WEATHERPROOF WIRE
- COTTON, PAPER AND ASBESTOS MAGNET WIRE (In rounds, flats and squares)
- RUBBER INSULATED WIRES AND CORDS
- SYNTHETIC INSULATED WIRES AND CABLES (Thermoplastic—Neoprene)
- LEAD COVERED CABLES
- SERVICE ENTRANCE CABLES

★ ★ ★

"Rome 60" Heavy Duty Cords and Cables

ROME
CABLE CORPORATION
ROME, N. Y.

SALES OFFICES

NEW YORK
60 E. 42nd St.

CHICAGO
208 S. Jefferson St.

LOS ANGELES
327 E. 4th St.

PITTSBURGH
2537 Koppers Bldg.

CLEVELAND
817 Citizens Bldg.

PHILADELPHIA
1803 Liberty Trust Bldg.

WASHINGTON, D. C.
410 Bond Bldg.

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2027 South Blvd.

DETROIT
547 New Center Bldg.

MARSHFIELD HILLS, MASS.

TO PROTECT YOUR CABLES
AGAINST MOISTURE *Use G & W Potheads*

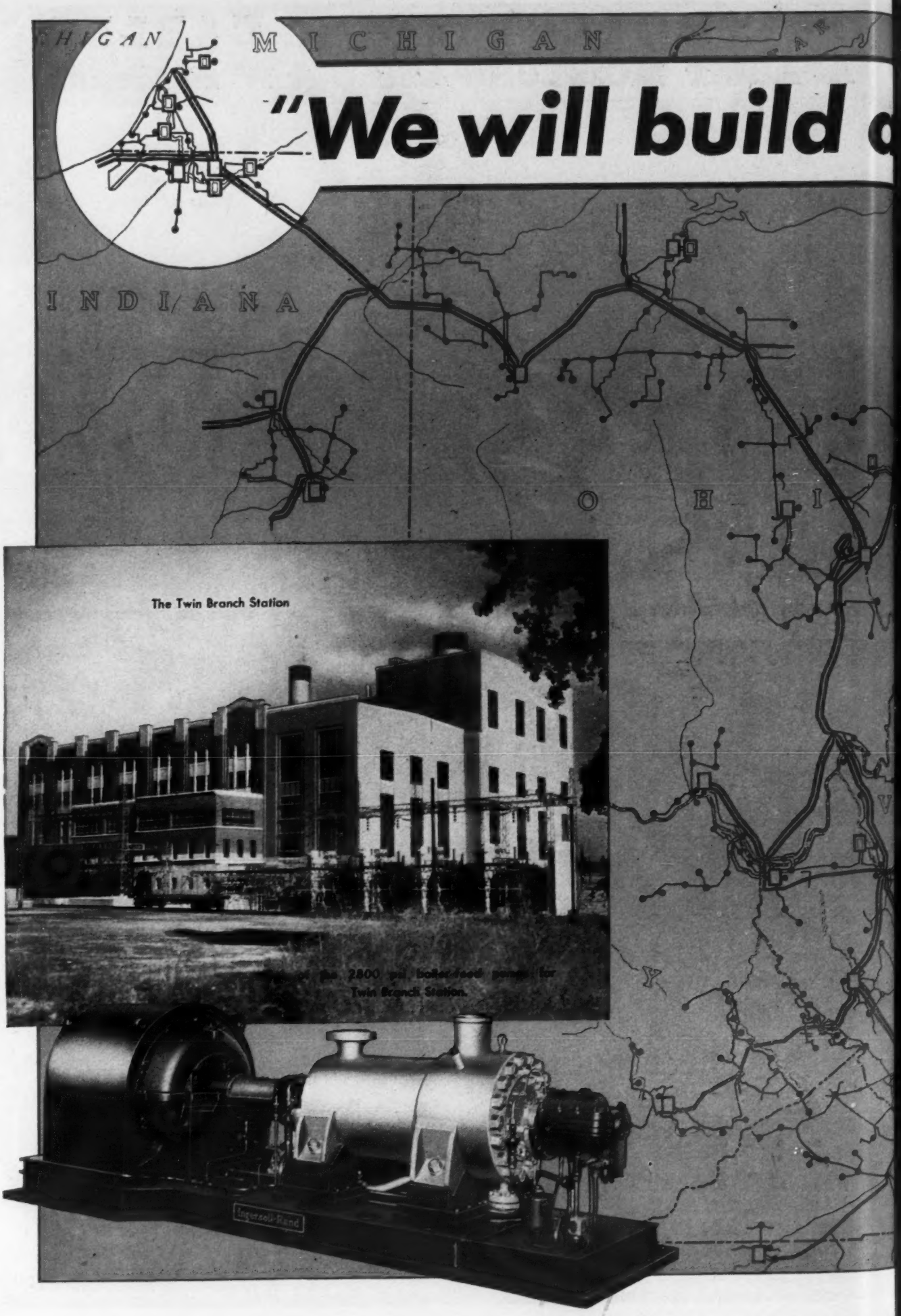
Joints stay tight under a *wide temperature range*

G & W ELECTRIC SPECIALTY CO.
7780 DANTE AVENUE
CHICAGO, ILLINOIS, U. S. A.
In Canada—Powerlite Devices, Ltd., Toronto

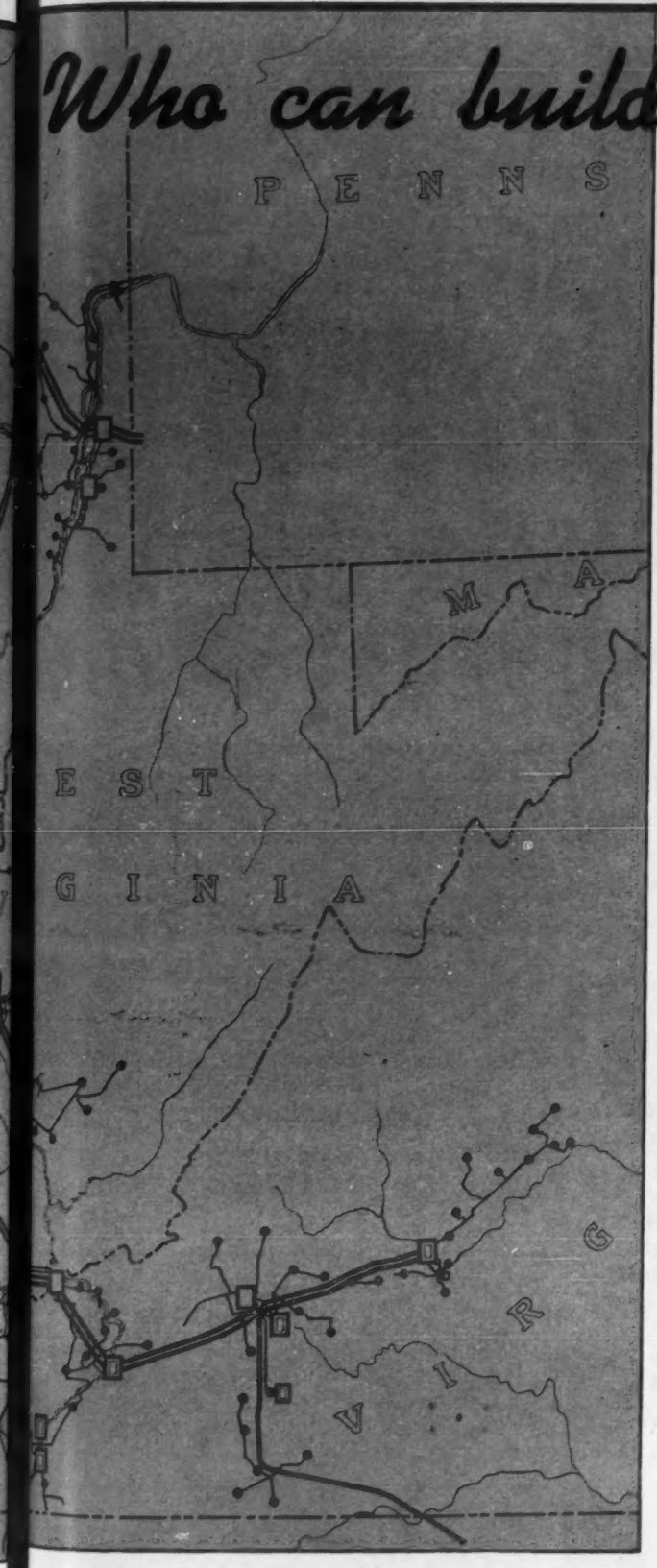
Write for BUL. 392 Pothead Listings, & BUL. DIP Directions for Installing Potheads.

G&W ELECTRIC CABLE DEVICES

POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNECTS


MICHIGAN
"We will build a
INDIANA
OHI
The Twin Branch Station
Twin Branch Station.
Ingersoll-Rand

2500 lb. station here"



Who can build the boiler-feed PUMPS?

When the American Gas and Electric Service Corporation planned a 76,500 kw high-pressure addition to the Twin Branch Station, no one had ever built boiler-feed pumps of this size for 2800 lb. per sq. in. pressure.

For years Ingersoll-Rand has been a leader in the manufacture of high-pressure boiler-feed pumps and had furnished pumps for every steam station in American Gas and Electric's Central System. So it was natural that Ingersoll-Rand should be asked to help solve the pump problem at Twin Branch.

Three 8-stage, boiler-feed pumps were supplied. Each has a capacity of 1230 gpm, a discharge pressure of 2800 psi, a suction pressure of 700 psi and handle boiler-feed water at 340°F. Each pump is driven by a 2500 hp, 3600 rpm motor.

Two primary boiler-feed or tank pumps were also supplied. These have a capacity of 1275 gpm, a discharge pressure of 700 psi, a suction pressure of 50 ft. and handle 262°F. water.

The 700 psi suction pressure of the boiler-feed pumps was selected so that the boiler-feed units from an existing section of the plant could be used as spare tank pumps. The new boiler-feed pumps have forged-steel, barrel-type casings. They were specially built for Twin Branch Station but the fundamental I-R design had been proven in other boiler-feed plants and in the refining industry.

Twin Branch Station has now been successfully operating for two years. Result: More power to beat the Axis.

Ingersoll-Rand Company, Cameron Pump Division, 11 Broadway, New York, N. Y.

Ingersoll-Rand

10-316

CENTRIFUGAL PUMPS • CONDENSERS • COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • OIL AND GAS ENGINES

If your present manufacturing operations or postwar plans involve product parts where high dielectric and mechanical strength is essential, consult Westinghouse.

Skilled Micarta engineers will be glad to study your product . . . analyze its applications . . . give you the benefit of 35 years' experience with industrial plastics.

This experience is particularly extensive with respect to applications where effective insulation is necessary . . .

FOR EXAMPLE, IN THE MANUFACTURE OF RADIO EQUIPMENT for the Army and Navy . . . tube sockets, coil forms, variable resistor housings and terminal strips are all made from Micarta plate and tubing.

ON FIGHTING SHIPS . . . Micarta panels are used in circuit breakers that control gunfire equipment . . . in cable cleat blocks used to separate power cables from bulkheads.

AND IN MANY OTHER INDUSTRIES . . . hundreds of thousand of Micarta parts are used where dielectric strength an dependability are vital.

In many of these applications Micarta ha replaced unavailable critical materials and i serving better, due to its unusual properties. It a fact, for instance, if you were to wear Micart "gloves" ½" thick, you could stand on wet groun and safely handle a high tension wire carryin 250,000 volts.

For complete Micarta data, phone your neares Westinghouse office or write to Westinghous Electric & Manufacturing Company, Dept. 7-N East Pittsburgh, Pennsylvania. J-09

TYPICAL MICARTA TOUGH JOBS IN WAR APPLICATIONS

Aircraft structural parts	Protective helmet liners
Industrial gears	Aircraft control pulleys
Steel mill bearings	Bus supports
Thrust washers	Fuse mountings
Marine bearings	Insulating washers

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

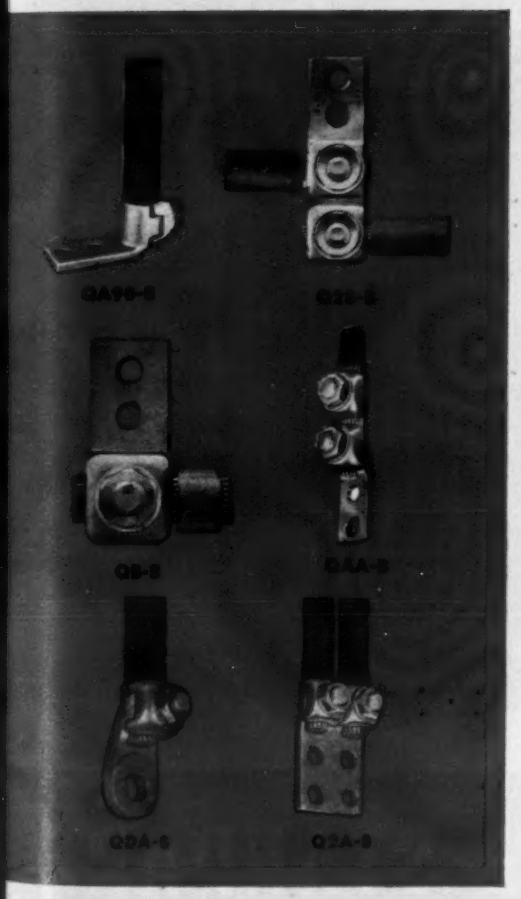
Micarta

The INDUSTRIAL PLASTI

CUT CORNERS and CUT COSTS

KPA QA-B

Burndy SCRULUGS and QIKLUGS



Both these favorites are *unit* assemblies. Thus cables can be inserted easier and quicker . . . and there are no extra parts to loosen or lose. This feature assures a *stronger, more efficient* connection, too. Both are furnished with tongues blank, or drilled as required.

The Scrulug provides extreme compactness, with high mechanical strength. Only 4 sizes are required to accommodate cables ranging from #4 to #200 . . . or from #14 to 4/0 strand.

The Qiklug also provides extreme compactness, and is equipped with an oversize stud to eliminate all danger of stripping or distortion when tightening. And only 11 sizes of the standard Qiklug are necessary for cables ranging from #3 to 2000 mcm. Also supplied in variations to meet all connector needs.

Catalog giving complete information on these and other time-saving, cost-cutting Burndy connectors gladly sent on request.

Headquarters for connectors

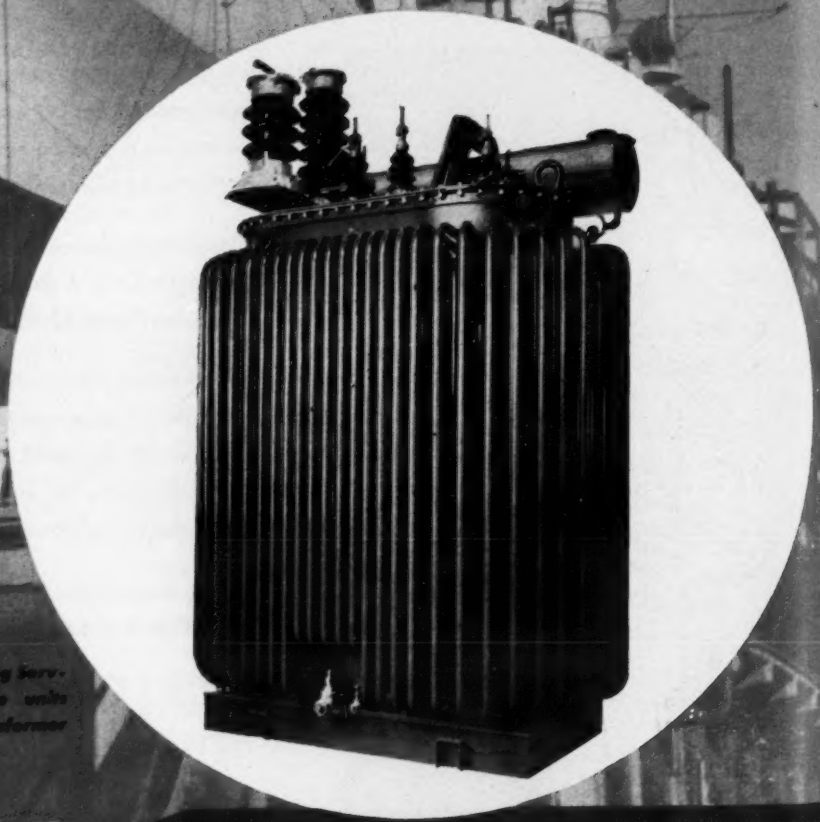
Burndy

BURNDY ENGINEERING CO., INC.

107 Eastern Boulevard • New York 54, N. Y.

ELECTRIC POWER

FOR BUILDING BATTLESHIPS



Use Standard Engineering Service to help select the units that will solve your transformer problems.

THE STANDARD T

Official U. S. Navy

OR LIGHTING A FARMHOUSE

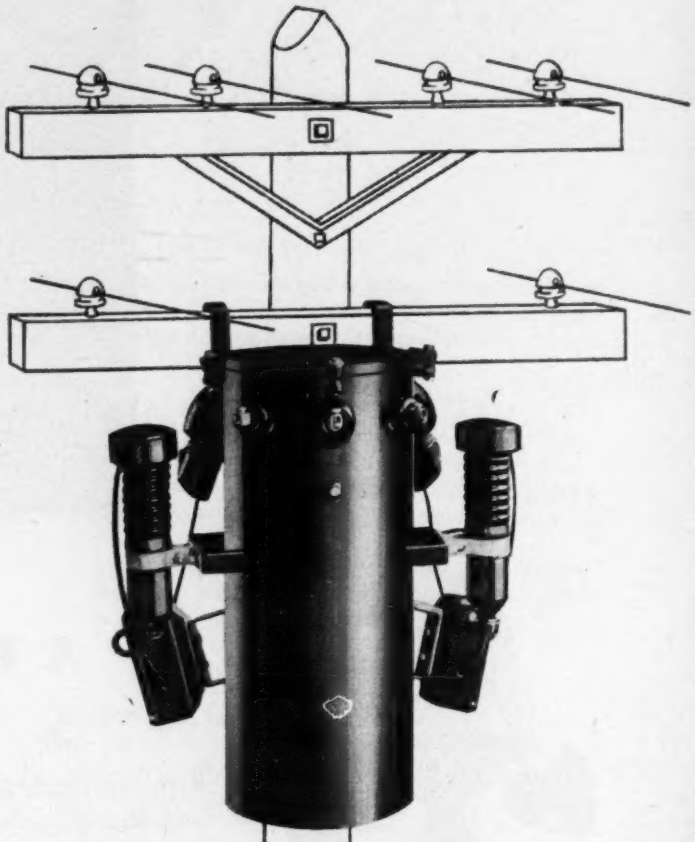
Delivered "as you want it"

by Standard TRADE MARK TRANSFORMERS

Forming dependable links in vital electric power supply lines, Standard Transformers are installed the world over—in Navy Yards, Power Stations, Armament Plants . . . and in farm areas.

To help you get electric power "as you want it," Standard offers a complete line of equipment and a staff of experienced engineers backed by a smooth-running manufacturing organization.

A letter or wire will quickly put the nearest Standard representative in touch with you.



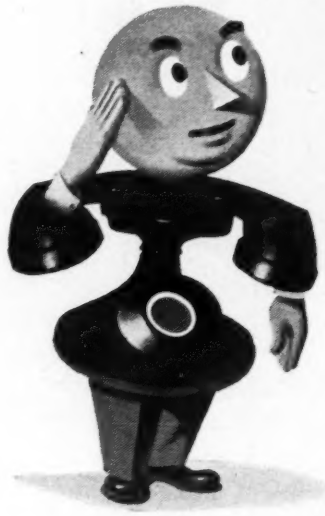
ENGINEERED AND BUILT

To meet Your needs

The flexibility of the Standard Manufacturing process; the experience and resourcefulness of Standard engineers, enables us to design, build and deliver *promptly,* dependable, efficient transformers to meet your needs. From the smallest types to 10,000 KVA. units—liquid or air cooled—individual transformers or unit substations—you can depend on Standard Transformers.

One of the newest type Standard distribution transformers is shown above. Dependable, efficient, economical. Entirely self-protected (Type ESP.)

TRANSFORMER COMPANY WARREN, OHIO



A Flag with 46,200 Stars

THE service flag of the Bell System had 46,200 stars on May 1. It has a lot more now. Telephone men and women are serving with the armed forces everywhere.

Those who are right in the middle of the fighting realize especially the importance of the telephone job back home.

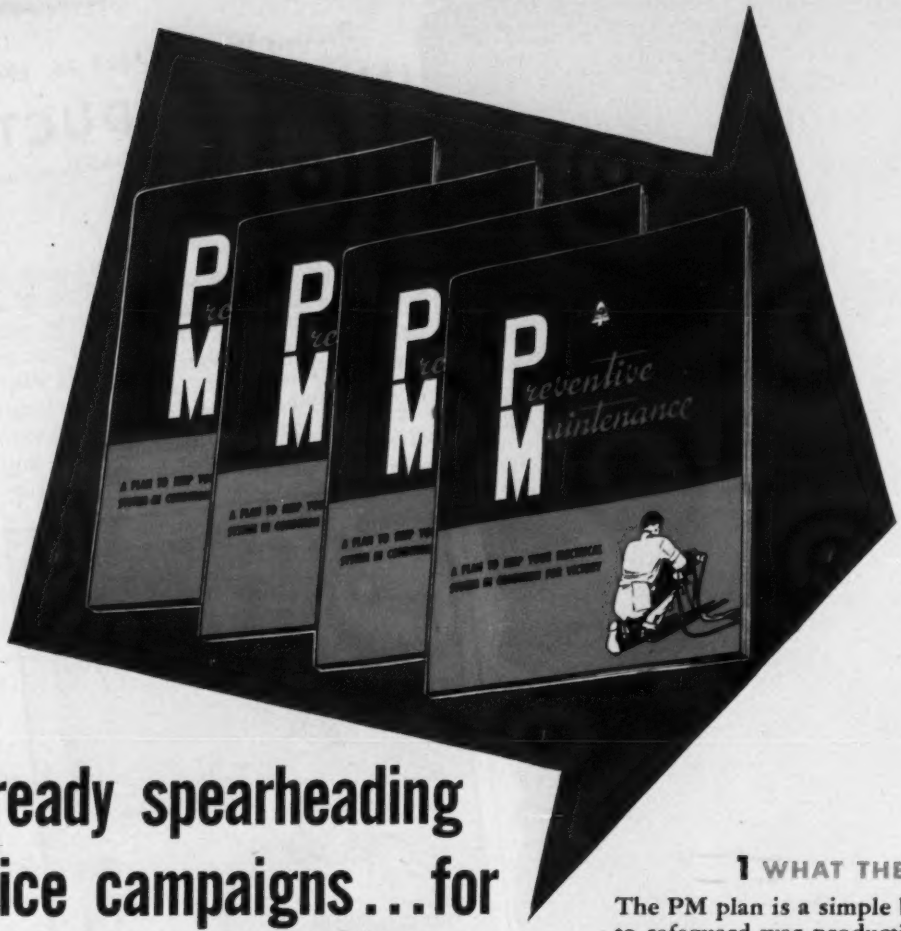
"Tell the gang," their letters say, "to keep on plugging.

"We wouldn't have the stuff for fighting if the rest of the Bell System wasn't sticking to the job and pushing through the calls that get things done.

"Takes team-work to win a war — especially a big one like this."

BELL TELEPHONE SYSTEM

★ *Your continued help in making only vital calls to war-busy centers is more and more essential every day.*



Already spearheading service campaigns...for more than 40 Utilities

THE PM PLAN

Introduced a short time ago, Anaconda's Preventive Maintenance Plan is being widely used by utilities to help customers keep electrical systems operating *efficiently*—despite shortages in essential wiring equipment.

Already some 40 utilities are actively engaged in this program. With it, they are helping their industrial power customers maintain continuous wartime production by preventing electrical breakdowns.

1 WHAT THE PLAN IS

The PM plan is a simple but comprehensive way to safeguard war production by preventing electrical breakdowns *before they develop.*

2 HOW IT WORKS

The plan provides a practical means of making periodic, systematic analysis of circuits and equipment. Uncovers potential weaknesses . . . suggests ways to correct them . . . prevents overloading of lines.

Data thus gathered aids local W.P.B. Branches in reaching decisions on requests for materials to *prevent* breakdowns.

3 HOW UTILITIES BENEFIT

The PM plan helps utilities maintain close customer contact despite a lack of "something to sell." Offers basis for service campaign that definitely appeals to customers. Puts the utility in a leadership role for furthering war production throughout the area it serves.

If you aren't already utilizing the Anaconda Preventive Maintenance Plan, mail the coupon for full details.

43234

"Tomorrow may be too late . . . do it today!"

ANACONDA'S PREVENTIVE MAINTENANCE PLAN

Anaconda Wire & Cable Company
25 Broadway, New York City

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding wartime production.

Individual .....

Company .....

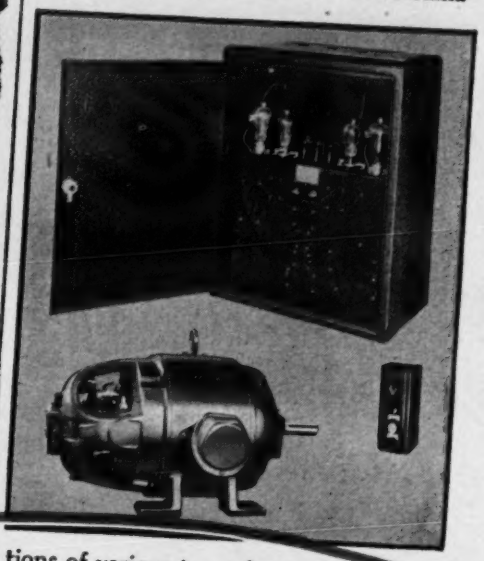
Address ..... City .....

IL

NEW PRODUCTS

Electronic Drive

Because most a.c. motors are built for a single designated speed, and most industrial plants are supplied only with a.c. power, manufacturers use various expedients to secure variable speeds when needed. These can take many forms ranging from step-cone pulleys and variable speed gears on machine tools and other equipment to elaborate installations of various types for converting a.c. to d.c., permitting use of d.c. motors.



Newest method of changing speeds is electronic, wherein thyratron tubes take just as much a.c. power as is needed for a given speed and convert it for a d.c. motor. Newest outfit of the type is the Mot-O-Trol Electronic Adjustable-Speed Drive, just announced by Westinghouse Electric & Mfg. Co., East Pitt[illegible] a cabinet [illegible] something like a radio, a switch, and a shunt-wound d.c. motor. You set a radio-like dial to the speed desired and flip the switch. A standard drive is available for ratings up to 1 hp. and a speed range of 1 to 20; more powerful drives can be designed to special order, with wider speed ranges.

J-21287

P.S.
WE'LL BE GLAD TO SEND YOU THE FULL STORY . . .
ASK FOR NEW BULLETIN B-3256
Westinghouse ELECTRONICS
WESTINGHOUSE
Westinghouse ELECTRIC & MFG. CO.

WAR POWER
. . UNRATIONED!

ASSEMBLING giant high tension switches for the distribution centre of Grand Coulee Dam power plant, these men are typical of thousands on the job day and night to make available to the war plants of America unlimited electric power.

To handle industry's wartime requirements for electric energy, power plants everywhere are maintaining their steam turbines at maximum power output, by lubricating them with *Texaco Regal Oil.*

Texaco Regal Oils rapidly free themselves from air and water, and highly resist oxidation, emulsification and sludge formation, assuring normal bearing temperatures . . . and governors instantly responsive to every load-change.

So effective have Texaco lubricants proved that they are definitely preferred in many other important fields, a few of which are listed below.

A Texaco Lubrication Engineer will gladly cooperate in the selection of the most suitable lubricants for your equipment. Just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

- More buses, more bus lines and more bus-miles are lubricated and fueled with Texaco than with any other brand.
- More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.
- More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.
- More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.
- More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

TEXACO

TEXACO Regal Oils
FOR ALL TURBINES

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT — CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

FROM SHORE BASES to SHIP BROADSIDES...

OFFICIAL U. S. NAVY PHOTO

AmerTran Serves the NAVY!

AT SHORE BASES

POWER TRANSFORMERS

•

HIGH VOLTAGE TEST EQUIPMENT

ABOARD SHIP

SEARCHLIGHT CONTROL

•

ANTI-AIRCRAFT RANGE FINDERS

•

FIRE CONTROL

•

UNDERWATER SHIP LOGS

THE wide range of AmerTran applications is strikingly revealed in the many jobs they are doing for our Navy. At the bases are the AmerTran power transformers and high voltage test equipment. Aboard ship are AmerTrans in the searchlight control and anti-aircraft range finders. In fire-control, too, AmerTrans help keep the battlewagons on the target. Even under water, there are AmerTrans—in ship logs.

To meet these war needs, important advances are being incorporated in AmerTran products. They are being proved daily under severe service and climatic conditions. Your post-war AmerTran equipment will reflect these improvements in the form of greater ruggedness, economy, ease of installation and higher efficiencies.

☆

AMERICAN TRANSFORMER COMPANY

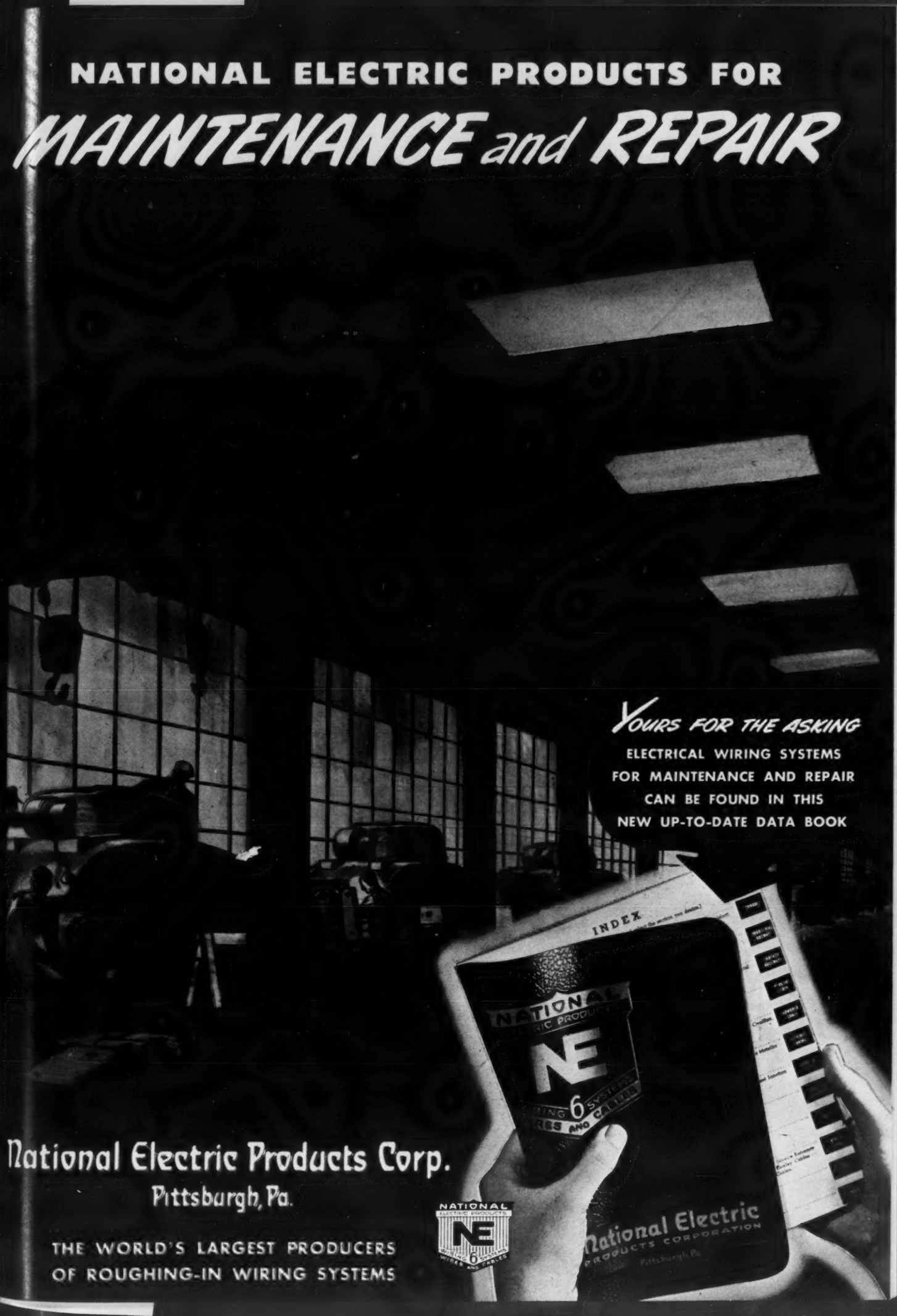
178 EMMET STREET, NEWARK, N. J.

PIONEER MANUFACTURER OF TRANSFORMERS, REACTORS AND RECTIFIERS FOR ELECTRONICS AND POWER TRANSMISSION

AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK, N. J.

NATIONAL ELECTRIC PRODUCTS FOR
MAINTENANCE and REPAIR



YOURS FOR THE ASKING

ELECTRICAL WIRING SYSTEMS
FOR MAINTENANCE AND REPAIR
CAN BE FOUND IN THIS
NEW UP-TO-DATE DATA BOOK

National Electric Products Corp.
Pittsburgh, Pa.

THE WORLD'S LARGEST PRODUCERS
OF ROUGHING-IN WIRING SYSTEMS

AS RECENTLY ANNOUNCED, *we are now building "Megger" instruments in this country, and are in production on the popular "Meg" and "Super-Meg" types. The acceptance accorded these new all-U. S.-made instruments has added to our already large backlog of orders, which we are now filling as rapidly as possible. Your orders for "Megger" instruments will be accepted according to priority ratings and with our assurance that delivery will follow as quickly as our further-expanding facilities will permit.*

FORESTALL electrical breakdowns ... WITH THE "MEGGER" TESTER!

Now, more than ever, it is vital to hold electrical failures to a minimum. Periodic testing of the insulation of motors, generators, cables, signal-control and other electrical apparatus can save priceless time and protect irreplaceable equipment. Testing with a "Megger" instrument is only a matter of minutes, but it can reveal potential damage and save days of costly delay.

"Megger" insulation testers are completely self-contained—wholly independent of batteries. Simply connect to the equipment under test, turn the hand cranked generator and read insulation resistance directly by the pointer over the scale. Over 40 years of service in industry has proved the value of "Megger" Practice.

Write for any or all of the bulletins listed and a free copy of the Pocket Manual of "Megger" Practice, No. 1420-W.

BIDDLE BULLETINS

- Use of Hand-driven "Megger" Tester, Bulletin 1655-W.
- How to Test Insulation and Avoid Trouble in Electrical Equipment, Bulletin 1640-W.
- Various types of "Megger" Insulation Testers, Catalog 1685-W.
- Bulletin 1735-W on the New U. S.-made "Megger" Insulation Tester in plastic molded case.

JAMES G. BIDDLE CO. · 1211-13 ARCH STREET · PHILADELPHIA 7, PENNA.

Wiring Voltages

The shortages of critical materials in this war will probably have a more profound effect upon interior wiring design than any other one thing that has happened in the past twenty years. In the first place the industry and the public have through experience of the war years come to understand that many of the old bugaboos are not so frightening after all. It's like learning to eat olives—not so bad if you eat a few.

Most important of the war practices is that of higher voltages resorted to in order to save copper. How far will we go? In the case of cold cathode lighting the tube voltages will be in the thousands, but for hot cathode circuits, at least for commercial and industrial interiors, we must be prepared to accept 440 volts.

With the incandescent lamp 110 volts gave the greater efficiency in light output, but that isn't so with the fluorescent lamp. In fact, the higher voltage will be better.

The only important hurdle that will have to be taken after the war is that of safety to life. During the war the code makers have interpreted voltages of this range to be safe provided equipments were mounted high enough to be out of the reach of a worker and provided they were not separately switched.

This raises the question of whether 440-volt electricity is more dangerous when supplying a lighting circuit than when supplying a motor circuit. While this may sound like one of the new moron conundrums, it isn't meant to be silly at all. The distinction lies, first, in the training of the person or persons using each and, second, in the more rugged character of motor circuit devices.

Isn't that our lead, then — build more safety, if necessary, into the devices for controlling lights instead of such artificial limits as are presently in the wartime interpretations?

For residences, the question is not so simple, nor, for that matter, is it at all pressing. It is probable, however, that the future may see a demand for 220-volt wiring in homes. It would be smart for wiring system designers to be studying the problem now.

This question of higher voltages, however, involves other problems than safety. Markets for the expansion of electrical service and energy-consuming devices and apparatus are definitely limited by voltage because of higher cost and load limitations of lower voltages. Considering the pressing post-war need for employment, this is not an unimportant matter.

In other words, there is not only the technical problem of safety to be considered but the policy problem of future markets. Shall we then leave this matter entirely to the decision of those charged with code revision, whose past history has always been tinged with extreme conservatism, or shall we also, through joint industry deliberations of executives, study the broader aspects of better service to the public, larger markets and greater employment?

Treatment and Stubbing Extend Pole Life—I

A comprehensive program of inspection, records, tables, ground-line treatment, stubbing and pole mounts aimed at maximum economy of pole plant investment and maintenance

J. G. CHAREST, Pennsylvania Power & Light Company, Hazleton*

GENERAL OBJECTIVE of a pole program for the system has been to direct and control pole maintenance in such manner that the annual cost will steadily be reduced. The result is a maximum return upon the money expended consistent with maintenance of a high standard of service, a satisfactory physical condition of the pole plant and the cultivation of good public relations. It is confidently believed that this program has extended the useful life of poles by an average value of at least five years and probably more.

Program Outlined

Over the last thirteen years this program has embraced the following measures in addition to adoption of treated poles for all new installations:

1. Reinforcement of deteriorated poles by use of
   (a) Wooden stubs.
   (b) Pole mounts.
   (c) Metallic reinforcements.
2. Elimination of all unnecessary deteriorated poles.
3. Resetting deteriorated poles when practical.
4. Development of engineering criteria for replacement, reinforcement, resetting and ground line treatment.
5. Establishment of an inspection program.
6. Establishment of a report and record system.
7. Life extension of partly deteriorated poles by ground line treatment:
   (a) Charring and spraying with hot creosote.
   (b) Osmoplastic treatment.

At present there are approximately 400,000 poles on the system. These are segregated as to types of initial treatment as follows:

	Percent
Hot and cold treatment	50
Brush treated	14
Pentrex treatment	6
Zinc meta arsenate	8
Creosoted	1
Untreated	21
	100

When any deteriorated pole requires rehabilitation, first consideration is given to the possibility of eliminating it, which may require some rearrangement of adjacent facilities, such as removing two poles and installing the new one midway between. Such respacing is usually planned in advance for lines having unnecessarily short spans. When elimination is impractical the possibility of cutting off, treating new ground line area and resetting is considered. Next, consideration is given to butt reinforcing. The pole is replaced only after all the above methods of rehabilitation are considered impractical.

Pole Reinforcing

System wide use of pole reinforcements was instituted in 1931. From 1934 to 1937 about 1,200 to 1,600 deteriorated poles were reinforced annually with wood stubs. The activity rose at 5,500 per year in 1937-38 and dropped to 2,500 in 1939. The present program is about 1,200 per year. From 1935-37 a very few Hammel & Williams pole mounts were used; they are as effective as wood stubs, but can be justified only where the cost of pole replacement is more than $70. Other types, however, have rather definite strength limitations; in some instances they develop little

*Superintendent of Lines and Substations.

PPL FORM 298 R—100M-11,38-35260

Pole Inspection Record

PENNSYLVANIA POWER & LIGHT CO. POLE No. 1919

LOCATION N. W. Corner of Fulton Court & Maple St. Hazleton

DATE INSPECTED	BY	FORM 349 R SHEET NO.	NEXT INSPECT'N DATE	REMARKS OR RECOMMENDATIONS
			1935	
6-1-35	C	9	1939	
5-12-39	R.B.T.		1941	
8-15-40	C	34	1945	
4-30-45	R.B.T.			"C" Tagged

FIG. 1—Pole inspection record calls pole up for inspection and aids inspector in routing his work

ore than half the original strength f the pole.

About 2,000 Nepsco reinforcements were installed from 1936 to 938 and a limited number of Allen teel-channel pole supports were used n 1937-38. Wood stub type of pole einforcing is preferable to all other ethods used, except that it is objectionable in appearance in prominent locations and may be an obstruction in restricted or heavy traffic ocations.

Pole Elimination and Resetting

Practice of eliminating deteriorated oles where possible has resulted in he removal of 4,800 in the last six ears.

When a deteriorated pole has excess eight and at least a 2-in. shell of ood wood at the new butt end the ecayed butt is cut off and the pole eset in place after treating the ground ine section with Osmoplastic. This ole must, however, have strength at he new ground line comparable to hat of the new pole which would therwise have been installed, and ust be treated, otherwise the life of he reset pole would probably be less han six years. There have been approximately 2,000 poles reset in the ast five years.

Inspection Procedure

Among the operating instructions esigned to execute this program of ole conservation are the following nspection rules:

All new poles, regardless of kind, hall be inspected ten years after installation except that groups of questionable chestnut poles may be inpected earlier at the discretion of he division superintendent.

The next inspection date shall always be one year prior to the inpector's estimate of the end of the seful life, but not to exceed ten ears.

Inspections of reinforced and reset oles to determine the condition of he old pole and of the reinforcement hall be made at intervals not exceedng five years.

Remove the ground to a depth of *least 8 in.* around the pole and reove exposed deteriorated wood.

Obtain the original circumference, nd the circumference after removal f decayed wood, near the ground ne, where the greatest reduction in ircumference has been made.

POLE RECORD
PENNSYLVANIA POWER & LIGHT CO.

TOWN Hazleton — POLE No. 6512
LINE OR FEEDER 11-4 KV. — MAP REF. No. 5-3
LOCATION Corner Broad & Church Sts.

OVERALL HEIGHT	CLASS	KIND	SET DATE	SET ORDER No.	MAINTENANCE DATE	MAINTENANCE ORDER No. SHEET No.	RESET REINFORCED TREATED	RE-LOCATED DATE	RE-LOCATED ORDER No.	REMOVED DATE	REMOVED ORDER No.
40	2	C N	1925	1162							
					1935	Sh. 9	Tr.-O				
35	2				1939	W.O. 714	Reset & Tr.				
					1945	Sh. 7	Tr.-O			1948	613
35	3	P C	1948	613							

INSPECTED DATE	INSPECTED BY	NEXT INSPEC. DATE
1935	C	1939
1939	C.J.B.	1944
1944	C.J.B.	1946
1945	C	1948

PERMIT No. 47620 — R/W AGREE. No.
JOINT WITH B. T. Co. — VESTED OWNER P. P. & L. Co.
MAINTAINED BY P. P. & L. Co. — JOINT POLE AGREE. No. 648

FOREIGN COMPANY ATTACHING	RENTAL(R) CLEARANCE(C)	DATE	AGREE. No.
A. T. & T. Co.	R	1930	6295

REMARKS
Pole set in concrete sidewalk

FIG. 2—History card records file data of pole location, dimensions, inspection dates and maintenance

Determine the extent of internal rot and quality of remaining wood by taking increment borings at 6 in. below and 1 ft. above the ground line. If internal decay is found at these points take an additional boring at 4 ft. above the ground line.

The inspector shall arrange to have a lineman assist him in determining the condition of a pole which appears questionable in the upper portion.

Obtain the number and depths of rot pockets.

In case it is inadvisable to remove paving from around the pole, a brace and bit shall be used to ascertain condition of pole below pavement. If the pavement is removed for inspection and the pole is found to have less than two years life, the pole shall be replaced promptly before restoring the paving.

Avoid, as far as possible, damaging solid treated pole surface, which would cause premature decay. This shall not preclude careful inspection of the surface or careful prodding of suspicious spots.

Standard creosote treated or locust heart wood untreated $\frac{7}{16}$ x $1\frac{1}{2}$-in.

Hazleton DIVISION

POLE BUTT TREATED RECORD
PENNSYLVANIA POWER & LIGHT CO.

Accounting Local No. 3 — Sheet No. 9

POLE NUMBER	TYPE	LOCATION	CONDITION OF WOOD 6 IN. BELOW GROUND	CONDITION OF WOOD 1 FT. ABOVE GROUND	CONDITION OF WOOD 4 FT. ABOVE GROUND	CIRCUM. FERENCE GRD.	CIRCUM. FERENCE NEW	ROT POCKET	REM. LIFE	TREATED DATE	TREATED TYPE	REMARKS RECOMMENDATIONS
6512	C N	Broad & Church Sts.	G	G	—	36	29	1-4"	5	9-1-35	O	
6513	C N	Church, 1st Pole N of Broad	0-2"	0-3"	0-6"	34	33	—	0	—	—	C Topped - Replace
6514	C O	Church & Green Sts.	0-4"	0-6"	6	40	38	1-8"	7	9-1-35	O	
6515	C N	Church, 1st Pole N of Green	P-6"	P	6	38	38	—	1	—	—	C Topped - Replace in Concrete

Type Pole—Chestnut CN; Y. Pine - ZMA PZ; Y. Pine - Creosote PC; Cedar CD
Type Treatment—Osmose O; Char & Spray X
Foreman R. B. James 9-1-35
Recorded By O. K. Smith

FIG. 3—Sheet used by construction department's treating or inspection crews and operating department inspectors to record both treatments and inspections

Table I—Load per Conductor Due to ½-in. Ice and 8-lb. Wind (Lb.)

Size and Kind of Wire	100′ Span	150′ Span	200′ Span	250′ Span	300′ Span	350′ Span	400′ Span	450′ Span	500′ Span
No. 6 Solid bare copper	78	116	155	194	233	271	310	349	388
No. 4 Solid bare copper	80	120	160	201	241	281	321	361	401
No. 2 Solid bare copper	84	126	167	210	252	294	336	378	420
No. 1 Solid bare copper	86	129	172	215	258	300	344	387	430
No. 2 Str. bare copper	86	129	172	215	259	302	345	388	431
No. 1 Str. bare copper	89	133	178	222	267	311	355	400	444
No. 1/0 Str. bare copper	92	137	183	229	275	320	366	412	458
No. 2/0 Str. bare copper	95	142	189	236	284	331	378	425	473
No. 3/0 Str. bare copper	98	147	196	245	294	343	392	441	490
No. 4/0 Str. bare copper	102	153	204	255	306	357	408	458	510
No. 6 Solid T.B.W.P	89	133	177	221	266	310	354	399	443
No. 4 Solid T.B.W.P	91	136	181	227	272	317	363	408	453
No. 2 Solid T.B.W.P	96	144	192	240	288	336	383	431	479
No. 1 Solid T.B.W.P	97	145	194	242	291	339	387	436	484
No. 1/0 Str. T.B.W.P	107	161	214	268	321	375	428	482	536
No. 2/0 Str. T.B.W.P	111	166	222	277	333	388	444	499	554
No. 4/0 Str. T.B.W.P	119	179	238	298	357	417	476	536	595
No. 4 A.C.S.R	84	126	168	219	251	293	335	377	419
No. 2 A.C.S.R	88	132	176	219	263	307	352	395	439
No. 1 A.C.S.R	90	136	181	226	271	316	361	407	452
No. 1/0 A.C.S.R	93	140	186	233	280	326	372	420	466
No. 2/0 A.C.S.R	97	145	193	241	290	338	386	434	483
No. 3/0 A.C.S.R	100	150	200	250	300	350	400	450	500
No. 4/0 A.C.S.R	104	156	208	260	312	365	417	469	521
No. 7A Str. Copperweld-Cu	82	123	163	204	245	286	326	367	408
No. 6A Str. Copperweld-Cu	82	123	164	205	246	287	328	369	410
No. 4A Str. Copperweld-Cu	86	129	172	215	258	301	345	387	430
Twisted-pair telephone wire	90	135	180	225	270	315	360	405	450
50-Pair telephone cable	115	170	230	290	345	400	460	520	575

Table II—Load per Conductor Due to Angle (Lb.)

Size and Kind of Wire	Break Angle							
	2°	4°	6°	8°	10°	12°	14°	15°
No. 6 Solid bare copper	22	43	65	87	108	130	151	162
No. 4 Solid bare copper	34	68	103	137	171	205	239	256
No. 2 Solid bare copper	55	109	163	218	272	326	380	406
No. 1 Solid bare copper	65	130	196	261	326	391	455	488
No. 2 Str. bare copper	55	109	163	218	272	326	380	406
No. 1 Str. bare copper	69	138	208	275	343	412	480	515
No. 1/0 Str. bare copper	70	140	210	279	349	418	487	522
No. 2/0 Str. bare copper	70	140	210	279	349	418	487	522
No. 3/0 Str. bare copper	70	140	210	279	349	418	487	522
No. 4/0 Str. bare copper	70	140	210	279	349	418	487	522
No. 6 Solid T.B.W.P	22	43	65	87	108	130	151	162
No. 4 Solid T.B.W.P	34	68	103	137	171	205	239	256
No. 2 Solid T.B.W.P	35	109	163	218	272	326	380	406
No. 1 Solid T.B.W.P	65	130	196	261	326	391	455	488
No. 1/0 Str. T.B.W.P	70	140	210	279	349	418	487	522
No. 2/0 Str. T.B.W.P	70	140	210	279	349	418	487	522
No. 4/0 Str. T. B. W. P	70	140	210	279	349	418	487	522
No. 4 A.C.S.R	45	81	136	181	227	272	316	340
No. 2 A.C.S.R	60	120	181	241	301	332	386	414
No. 1 A.C.S.R	70	140	210	279	349	418	487	522
No. 1/0 A.C.S.R	74	148	222	296	370	444	516	554
No. 2/0 A.C.S.R	70	140	210	279	349	418	487	522
No. 3/0 A.C.S.R	70	140	210	279	349	418	487	522
No. 4/0 A.C.S.R	70	140	210	279	349	418	487	522
No. 7A Str. Copperweld Cu	58	116	174	231	289	347	404	432
No. 6A Str. Copperweld Cu	54	108	162	216	270	324	376	404
No. 4A Str. Copperweld Cu	75	151	226	302	377	453	526	564
Twisted pair telephone wire	17	35	52	70	87	104	122	130
50 Pair telephone cable	70	140	210	279	349	418	487	522

wood plugs shall be inserted in bored poles unless the pole is condemned, in which case plugs shall not be used.

No inspection shall be made to determine the strength of wood when it is frozen.

Special care shall be exercised in determining the actual condition of wood which is thoroughly saturated with water because saturated poor wood often appears good.

Poles shall not be considered for reinforcement if the shell thickness of good wood is less than 2½ in. at lower attachment or if the portion above ground has less than three years remaining life.

Pole Ground Line Treatment

Eight different methods of ground line treatment of poles in service were investigated beginning in 1933. Since 1934 250,000 poles, of 300,000 requiring treatment, have been treated by two methods—150,000 by charring and spraying with creosote and 100,000 by the Osmoplastic method. Practically none of these treated poles have fallen since this program was instituted. Other treating methods investigated appear to be more expensive, less effective or a hazard to livestock or water supplies.

Both charring and spraying and Osmoplastic treatments are effective in preventing surface decay in ground line area. Results obtained from these methods are being continually studied and indications at present are that the Osmoplastic treatment might be more effective due to better penetration of the wood and may require less frequent application. It is estimated that either method should be effective for five to eight years. This extended pole life at the ground line will result in a continued reduction of the number of poles to be reinforced and reset.

Record System

Several forms are used in connection with recording information by the inspector and in the record department (Figs. 1, 2, 3).

Inspectors are provided with Tables I and II to guide them in their recommendations as to method of restoration or treatment.

A subsequent article will show a slide rule which has been devised to simplify computations of loading, number of bands required for stubbing, etc.

Phase Shifter Regulates Figure 8 Interconnection

Load division on three-utility system in Ohio, previously difficult, now superior — Tie-line loadings are controllable within requirements

L. P. FERRI, Ohio Public Service Co., and H. R. VAUGHAN,† Westinghouse Electric & Mfg. Co.*

INTERCONNECTIONS between electric utility systems have become very complex, and since it is imperative to use existing generation and transmission equipment to full capacity large regulating transformers are proving valuable for phase-angle or voltage control. A significant example is the phase-angle regulator (Fig. 1) installed and operating at a station of the Ohio Public Service Company to control the flow of power between three electric utility systems. This regulator, one of the largest ever manufactured and having the highest voltage rating, was applied after a system study had been made on the network calculator. It has accomplished its purpose with gratifying results.

Application Requirements

Electric power for the industrial load centers in the northeastern section of Ohio is supplied to a large extent by generating stations located in the coal mining region of southern Ohio. It is transmitted over a rather intricate network made up of interconnected 132-kv. transmission lines owned by the Ohio Edison Company, the Ohio Power Company and the Ohio Public Service Company. Completion of the interconnection formed a "figure 8" loop, made up of the Toronto-Boardman-Salt Springs-Warren - Alliance - Canton-Akron-Toronto tie lines (Fig. 2), over which considerable difficulty has been experienced in obtaining the proper division of power flow.

At times of heavy power demands in the Akron district the proportion of power flow over the Salt Springs-Warren and the Canton-Akron lines exceeded the limits prescribed by the contract between the three companies; this condition could be avoided only by opening the loop. Thus the purpose of the interconnection was defeated and the advantages gained by such an arrangement were completely nullified. A more workable solution was necessary, and so an extensive study was made of the system characteristics, including all possible conditions of loading and generation, conforming to normal and future operation. Certain possible changes in the network also had to be considered. Some of this information could have been obtained by tests and by laborious analysis, but it was found more practical and expedient to use an a.c. calculating board which gave the answers quickly, compactly and precisely. Representatives from the three involved utilities participated in making the study.

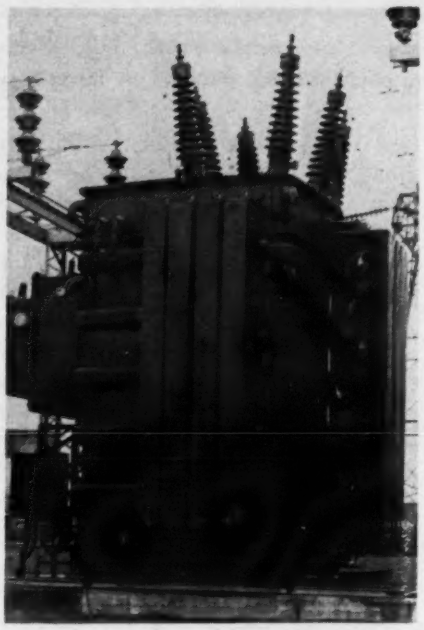


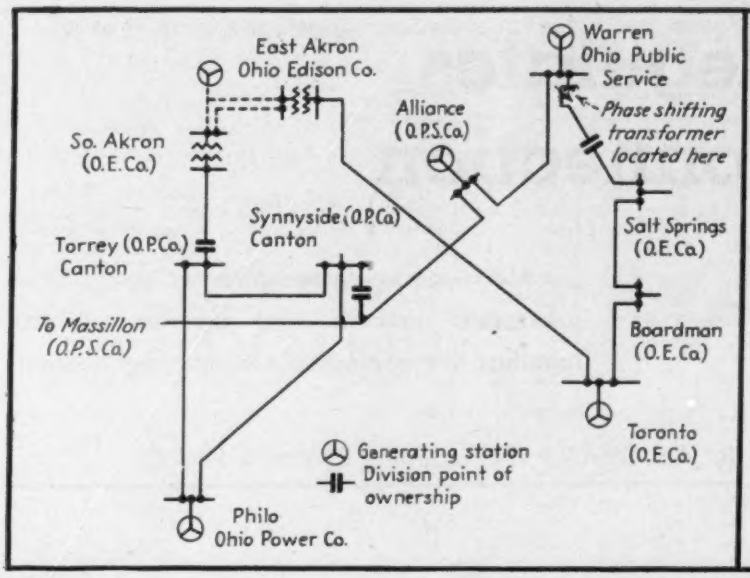
FIG. 1—Power flow between three interconnected systems effected by 138-kv. phase-shifting transformer

A phase-shifting transformer was selected as a means of maintaining power flow within contract limits after all other possible solutions were eliminated. A transformer, capable of shifting the voltage ±12 deg., was chosen because this angle was adequate for practically all possible conditions. The probability of abnormal conditions requiring more than 12 deg. shift did not economically justify a larger regulator. A very important phase of the study involved proper location of the regulator in the loop; it was installed at Evergreen substation of the Ohio Public Service Company in the tie line between Warren and Salt Springs. Line current, of course, determined the regulator size.

Description of Regulator

The regulator is rated 138 kv., 104.7 amp. when self-cooled, but has air-blast equipment to increase its rating to 139.5 amp. Provision is made on the terminal board (Fig. 3) for connecting the series transformer windings for either phase-angle or voltage control. When connected for phase-angle control the regulator is capable of shifting the voltage phase angle ±12 deg. in 16 equal steps in each direction. Connected for voltage control, it is capable of approximately

*Protection Engineer.
†Central Station Engineer.



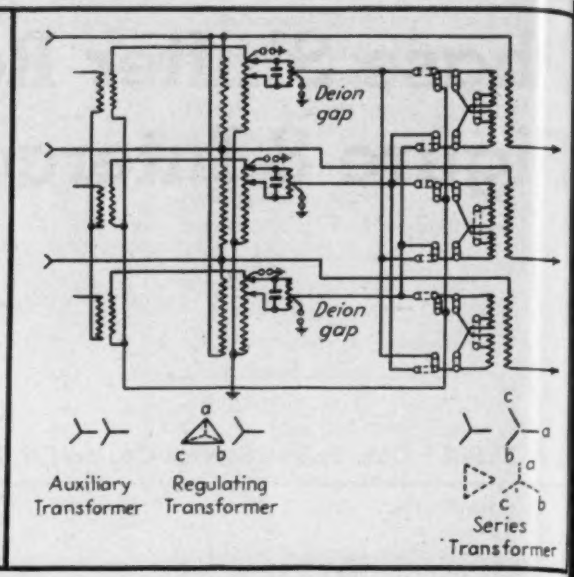


FIG. 2—Figure 8 loop involves three systems and three division points **FIG. 3—Either phase angle or voltage control obtainable**

Fig. 3—Full lines for ± 12-deg. phase-angle control; dotted lines for voltage control (20 percent buck or boost)

20 percent buck or boost in 16 equal steps.

The two-winding regulating transformer, the series transformer, the preventive auto-transformer and the three-phase auxiliary transformer for supplying power to the control and air-blast equipment all are assembled with their necessary leads and terminal connectors in a common tank. The tap changer is in a separate compartment attached to one side of the main tank; an opening is provided through which pass the leads from the regulating and preventive auto-transformers. Radiators and blower equipment are attached symmetrically around the remaining three sides of the tank to make the over-all floor space of the regulator approximately square. Fans are automatically started and stopped by a thermostat responsive to top oil temperature. Any one of the fans or radiators can be removed individually without taking the remaining fans or radiators out of service.

Because of its large physical size and weight, approximately 100 tons total, the regulator had to be carefully designed and proportioned to meet shipping clearances; nevertheless, shipment was made with the cores and oils completely assembled in the main tank and immersed in oil. The radiators, tap-changer compartments and bushings could be shipped separately without creating a major assembly problem at the time of field installation. The core was held to minimum size by using Hypersil iron and the tank diameter was reduced by bracing for vacuum treatment through use of channel-type bands around the outside periphery.

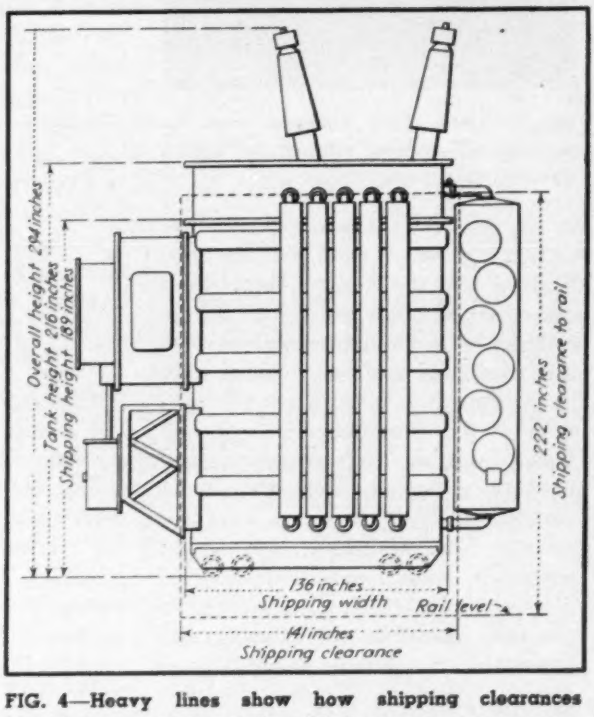


FIG. 4—Heavy lines show how shipping clearances (dotted lines) were met by shipping excrescences separately

Shipping height clearances (Fig. 4) were met by splitting the tank above the tap-changer throat; dummy covers were installed over the top of the tank and over the tap-changer opening. The shipping oil level, nearly up to the tank split, completely covered cores, coils and the terminal boards. By welding a vertical barrier in the tap-changer throat the need for lowering the oil level below terminal boards was eliminated. Only 1,500 gal. of oil was drawn off and shipped in separate containers; the rest of the oil remained in the main transformer tank, having a total capacity of 10,400 gal.

Protection and Control

Regulator, connected into the Warren-Salt Springs circuit (Fig. 5), is controlled manually from the station switchboard, where high-speed pilot-wire relays protect the line and regulator, considered as a unit, against internal faults. Lightning arresters connected to the substation bus and to the line side of the regulator guard against surges from the transmission line. Induced surges in the secondary of the exciting transformer or in the primary of the series transformer are taken care of by Deion gaps which are connected between the windings and ground;

these gaps are included as an integral part of the regulator. Component parts of the regulator insulation are completely co-ordinated and an atmosphere of nitrogen is automatically maintained in the space above the oil to preserve it properly.

A motor-operated air-break switch, remotely controlled from the switchboard, is provided to by-pass the regulator when its current-carrying capacity is exceeded or when it must be removed from service. An interlock prevents closing the switch except when the tap changer is in neutral position and quadrature voltage is zero. The interlock system may be extended to allow closing and opening the switch only when conditions are favorable for the operation.

Dispatcher at Massillon knows what loads are being transmitted through the Warren-Salt Springs line;

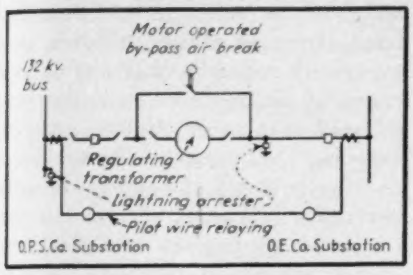


FIG. 5—Regulator included with transmission line in zone of high-speed pilot wire relays

the system of carrier current telemetering also registers conditions in the other tie lines in the loop. Therefore, he is able at all times to supervise the control of the regulator to maintain the desired division of power flow in the loop.

Results

The phase-shifting transformer was placed in operation in May, 1942, and its operation thus far has fulfilled all expectations. The tie line between Warren and Salt Springs, that formerly had to be kept open during certain parts of the day lest the power flow get out of hand, is now kept closed all the time. Only on rare occasions, when sections of the network were opened, has it been necessary to by-pass the regulator. It has proved its value as a means for controlling power flow in a high-voltage transmission loop of multiple ownership, where restrictions in tie-line loadings are necessary.

Conservation in Power Station Design

A summary of structural, mechanical and electrical design practices that contribute to the miniumum use of critical materials in modern power plant construction

F. H. HOLLISTER,* Sargent & Lundy, Chicago, Ill.

IN THE DESIGN of electric generating stations and associated transmission and distribution facilities engineers have always in the past balanced economics against conservative engineering. Today not nearly so much stress is put on economics as on conservation of material. As a result, important, strange and surprising results are being obtained. Many of these innovations will be retained and improved in the future. Few 100 percent reversions to previous practices and standards are to be anticipated.

We may look in the future for still further developments in conservation along lines already well established, particularly if the war should continue for several years. Fields which appear to offer the greatest potential for future developments in material conservation include:

1. Further steps in the standardization of equipment, apparatus and materials.
2. An extension in the range of use of hydrogen cooling in electrical apparatus and machines.
3. Substitution of reinforced concrete for steel in building structure columns, beams and girders.
4. Omission of windows from power and switch houses and improvements in air conditioning.
5. Design and construction of plants where the steam turbine and steam generating units are wholly or partially installed outdoors.
6. Development of new simplified systems for auxiliary power distribution.
7. Use of silver in the replacement of copper for buses in more places.
8. More economical use of cable and elimination of duplicate feeds and ties with the improvement in protective devices.
9. Operation of cables at higher temperatures after research and operating experience to check on probable life.
10. Use of protectives in electrical work to a greater degree, thereby permitting simplification of electrical systems and use less primary copper.
11. Improvement in the artificial cooling of transformers with air.
12. Cooling of switchgear with air to increase current rating either by circulation of air in the room or by forced filtration through equipment.
13. Extension in the use of common frame single-tank oil circuit breakers, also air circuit breakers.
14. Development of better and cheaper metallic and non-metallic surfaces in lighting luminaires.

Conservation steps already taken fall logically under one of two general headings—those applying to structural and mechanical design and those applying to electrical design of power stations.

Structural Design

Buildings for housing turbo-generators and steam-generating units are being designed today, almost without exception, with no walls between turbine and boiler rooms. Where turbines and boilers are operated from a common aisle, reduced manpower, better vision, shorter distances and more efficient operation are some of the advantages of this construction. Other savings are realized through shorter steam and piping connections, less ground space, less building material and more direct cable and conduit connections.

An extension of this idea has already been employed in three recently completed plants where the wall between the turbine room and the control and switchgear room was omitted. Thus, there is less over-all ground

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*Chief Electrical Engineer.

Abstracted from a paper presented at the Midwest Power Conference, Chicago, April 9, 1943.

space, less steel, and less other building materials required.

Further reduction in critical building material for columns and reinforced concrete has been accomplished by omitting large sections of the floors in turbine rooms, leaving the turbo-generator sets mounted on reinforced concrete "islands" with narrow walkways around the machines. In a certain recently designed 10,000-kw. two-generator power station by observing these features of design, a saving of some 32,000 lb. of steel was effected in a building 132x130 ft. and a turbine room.

Chimneys

To conserve steel new boilers are being built more frequently with reinforced concrete or brick chimneys than with steel stacks. It is estimated that a steel stack 100 ft. high and 20 ft. inside diameter requires about 30 tons of steel. A reinforced concrete chimney of like dimensions requires not more than 10 tons of reinforcing steel. While the steel stack with a brick lining costs more, it has a much longer life.

Some power station buildings and switch houses are being built without windows, or with glass block windows, to save metal frames, lintels and window operative device. This construction requires mechanical ventilation and air conditioning, but less tonnage of the steel. With or without windows, the building costs are about the same. With air conditioning provisions taken into account, however, the differences in costs are still not appreciable. Operating and maintenance advantages, however, make the closed type of building construction attractive.

Perhaps the latest innovation is in making the superstructure columns and beams in power houses and switch houses of reinforced concrete instead of steel. For example, a two-story switch house 200 ft. long x 50 ft. wide x 40 ft. high—400,000 cu.ft. —now being built of reinforced concrete will require 30 tons of reinforcing steel for columns, beams and girders. If steel were used 120 to 130 tons would be required. This means a saving of from 90 to 100 tons of steel. While there is a steel saving, the use of reinforced concrete in columns, beams and girders increased the size and the length of the building about 100 ft. This increased the amount of copper required for buses and connections about 1,000 tons.

In power house building several minor features are being treated differently: Floor sections are made of wooden or reinforced concrete instead of steel plate or grating. Window frames use wood instead of steel. Possibly wooden frames are better because they are non-rusting and have longer life. Wooden frames probably have 40 or more years life if painted. Steel sash might rust out after less than 20 years. Wooden stairs instead of steel are being used; wooden handrails and wooden louvers are common. Walls made with brick instead of concrete save approximately 20 percent in the cost. Where wood is used it is considered as only a temporary expedient, to be later replaced in most places by steel.

Certain mechanical design features which have been under consideration for some time have been hastened by the war. For example, during the past year or so the factor of safety in stresses in the design of boilers has been reduced from approximately 5 to 4. Recently WPB asked the A.S.T.M. to liberalize the rating on valves and fittings. Condensers are now being figured and designed to have less condensing surface for the same duty. Where structural steel was used for machinery bases, reinforced concrete is now used. Coal bunkers and ash hoppers are being built of concrete, instead of with steel plate. No more space is required, and equal life is expected.

Outside the power house, switchyards and substations have wooden columns or posts, beams and braces. The salvage value in a wooden structure is not so much as in a steel structure, but there is a considerable saving in steel. In one recently designed 138-kv., nine-bay switchyard, 155 x 200 ft., there was a saving in steel of 40 tons by using wood.

Electrical Design

The location and size of auxiliary motors are important determining factors in plant auxiliary power system. Each plant warrants a careful study before adoption of any scheme of auxiliary power distribution and service. For example, three years ago, in co-operation with the engineers of an operating company, a two-unit, 50,000-kw. plant was designed using a 460-volt loop bus in the boiler and turbine room basements for supplying power to the various motor-driven auxiliaries. The layout of mechanical equipment in this plant lent itself to such a scheme for distributing auxiliary power. A saving in over-all costs and a 20 percent saving in materials compared to that required for a radial system of distribution was expected. Upon completion, however, analysis showed only a small saving in favor of this scheme. Subsequently we considered a combination loop and network scheme for two other two-unit plants of like capacity, but after a very careful analysis were unable to show a saving for serving the power auxiliaries, although the differences weren't large.

Buses

Much can be done to conserve material in the selection and arrangement of copper shapes in buses. Our experience indicates that one or two channels, as required, are the best adapted for very heavy current-carrying requirements. On the basis of equal weights of copper, channels permit an increase in current capacity of about 50 percent over flat bars closely spaced. Conversely, for the same current-carrying capacity the sections of the channels can be reduced one-third. This is particularly true for currents of 2,000 amp. and upward.

Design of a 10,000-kw., two-unit plant is now being completed with nine feeders of generator voltage using a single bus with metal clad switching units. In ordinary times such a plant might have been designed with a double bus or a main and a transfer bus. In this particular instance there was an estimated saving of 6,600 lb. of copper in bus and bus connections alone, and 28,000 lb. of steel and other material, not including the materials in the breakers.

For another plant where the design has been completed recently Transite has been used instead of steel for inclosing the bus and copper connections external to the switchgear cubicles. It was necessary to derate the capacity of the conductors somewhat because of the poorer heat radiation, but it was estimated that by using ventilated Transite there was an over-all saving in non-magnetic metal of approximately 20,000 lb.

In outdoor switchyards, where currents on the order of 200 and 300 amp. are encountered, steel pipe and structural steel shapes have been used for buses, in place of copper bar or tubing. The amount of copper saved depends, of course, upon the extent of the installations.

Cable

Operation of cables at higher temperatures, we believe, will come and smaller cables will be used than heretofore for the same service.

Where cables are installed in pans or ducts, considerable saving in critical materials has been effected by omitting the interlocked armor—bronze and steel—from the cables and using as a substitute a lead covering with a protecting treated braid, or in some places a rubber or synthetic covering over the lead. While the alternates do not give the same mechanical or electrical protection, the expedient saves much metal material and is cheaper.

It is important in conserving critical materials to study carefully the method of installing cables. In a recent analysis of the amount of copper and steel for a specific power feeder installation in a particular switch house it was estimated that if the feeders were installed in iron conduit 270,000 lb. of steel and iron and 140,000 lb. of copper would be used. However, if the cables were installed in metal pans the amount of steel and iron could be decreased to 30 percent. On the other hand, if the pans were made of Transite the amount of steel and iron required would be only 13 percent. Because of poorer radiation, the amount of copper in the cables would have to be increased, possibly 20 percent, to hold the cable temperatures to reasonable limits.

In a recent installation involving large currents it was found that while the labor costs were higher, copper could be conserved by using smaller size single-conductor cables in preference to three-conductor cables or to larger size single-conductor cables. The over-all costs were not materially different, as follows:

Amount of power to be transmitted was 50,000 kw., at 0.85 p.f., 13,800 volts, three phase.

The length of the run was 1,000 feet.

Cables considered were:

(A) 10 three-conductor, 400,000 cir.mil
(B) 6 one-conductor, 3,000,000 cir.mil
(C) 12 one-conductor, 1,000,000 cir.mil

Estimated copper required was 37,000 lb. in (A) and (C) versus 55,500 lb. in (B), or a saving of 18,500 lb.

Estimated over-all costs were $58,000, $50,000 and $51,000, respectively.

Switches

In some plants fused knife switches, which were in common use 25 years ago, are being used again on low-voltage auxiliary power circuits instead of air circuit breakers. With this type of switch there is some saving of critical material, but because of the possibility of single-phase operation and its attendant dangers, also the hazard to the personnel when replacing the fuses, and the inadequacy of fuses for selective tripping, the use of fused switches in many applications will be discontinued and replaced when air circuit breakers are again available.

Transformers

One of the interesting developments in transformer design has been the improvement in ratings through the use of fans to accelerate the cooling of oil in self-cooled transformers, particularly above 1,000 kva. Manufacturers generally agree that the 55 deg. C. ratings of transformers can be increased 25 percent and that in units of 2,500 kva. and larger the ratings can be increased from 25 to 33 percent by this means.

The importance of transformer cooling in material conservation is well illustrated by the case of a particular transformer rated at 40,000 kva., 138,000/13,800 volts, single phase, 60 cycles, in which the amount of copper and steel required for an oil-insulated, self-cooled design was given by the manufacturer as 100 percent; for air pressure cooled 82 percent, and for forced-oil, forced-air cooled 73 percent.

Two other ways to save critical materials in transformers are the omission of spare transformers and the installation of three-phase instead of three single-phase transformers. Transformers are so reliable and failures so few that it is debatable if any considerable risks are taken. From 15 to 20 percent of material is being saved when three-phase transformers are substituted for three single-phase transformers.

Motors

Where motors with conservative ratings were formerly selected to assure ample capacity and longer life, engineers are now conforming to Limitation Order L-221 and selecting motors with ratings approximately 80 percent of the maximum determined horsepower demands. However, a thorough check on possible ambient temperatures is desirable in specifying the motors. In one power station where a 50,000-kw. turbo-generator unit and two 250,000-lb. boilers were installed last summer the ambient temperatures were found to be as follows: With air outside 100 deg. F., or 38 deg. C., the temperature in the turbine room basement was 50 deg. C., in the boiler room it was 55 deg. C., and in the penthouse over the boiler room it was 82 deg. C. In such a case motors should have total temperatures at rated full load corresponding to the maximum allowed by A.S.A. In certain cases the use of class "B" insulation is a desirable solution.

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Data on Jute Rope

From the Plymouth (Mass.) Cordage Company, in connection with government prohibition of supply of wartime (sisal) rope on utility orders comes these data on jute rope. Jute fiber is softer than either manila hemp or sisal, and is therefore less resistant to abrasion. Because of this greater care must be exercised in its use, *e.g.*, it should not be drawn over crossarms, dragged along the ground, or in tackle allowed to twist and chafe. Careful drying after becoming wet is necessary, as jute rope is more susceptible to rotting. The ultimate strength of jute rope is 60 percent of that of manila hemp. To distinguish it from any existing hemp or sisal rope, it is recommended that the ends of each length of jute rope put into use be stained with vegetable dye.

Maximum Loading of Jute Rope

Factor of Safety—5.

Size, Inch	Straight Pull, Lb.	1 Single Block, Lb.	1 Single-1 Double Block, Lb.	2 Double Blocks, Lb.
3/8	153	140	350	440
1/2	318	290	730	910
5/8	528	480	1,220	1,510
3/4	648	590	1,490	1,850
7/8	924	840	2,130	2,640
1	1,080	980	2,500	3,080

War Matters Absorb A.I.E.E. National Gathering in Cleveland

Responsibility of engineering profession in national and hemisphere affairs for war and post-war coupled with technical deliberations on pressing industrial and utility problems of production and loading

FOCUS on the problems and the developments of the war era continued to engross the sessions of the American Institute of Electrical Engineers when some 1,200 members met for a one-week national technical meeting in Cleveland, June 21 to 25, 1943. Several committees had expedited their reports constituting operating guides so the electrical industry can make the greatest possible contribution to war production in such ways as getting the most out of generating facilities, conductors and cables, protective devices, carrier relaying, etc.

One technical session was aimed at bringing forth a better understanding of the problem of rendering power supply to resistance welders; others of interest to industrial engineers were those on electronics and high-frequency heating techniques. Automatic reclosing devices on long rurals and the problem of relaying tapped transmission circuits and feeder loops aroused active discussion. Spirited discussion also took place regarding the relative merits of pilot wire and carrier relaying; it was provoked by a paper recording the 25-year evolution of the Chicago pilot-wire system.

New measurement techniques for potential and bushing-current transformers, a new high-voltage fuse and a high-speed balanced-current relay were among the signs of unremitting development for present and future requirements. Two sessions devoted to electrical equipment for military aircraft gave promise of many basic changes in store for equipments in other fields.

Early in the busy week there was an extended discussion of professional engineering relations with South and Central America. This was reported in the July 3, 1943, issue of ELECTRICAL WORLD.

Generation Capacity

Interim Report on Emergency Measures to Increase Output of Generating Equipment and Systems. . Committee. A revision of the tentative report initially presented at the winter and Kansas City meetings, discussing specific measures for extending capacities to safe loading limits, giving case citations of rebuilding and rehabilitation, and principles for enhancing the wartime outputs of systems.

What was called by S. H. Wright (Ebasco Services) "a 39-page handbook on system operations in wartime" brought forth from H. L. Wallau (Cleveland) the suggestion that it should prove extremely helpful to companies that add their last-for-the-duration kilowatts this year and need to husband what they have but nevertheless need to realize its full output capacity. The trend toward loading of generators by temperature was noted by R. P. Crippen (Ebasco) as no temporary measure, but something that would apparently survive and grow. C. M. Laffoon urged that managements get acquainted with their generators, that they realize on their emergency margins, but give new machines a year of seasoning and refrain from getting a habit of persistent and indiscriminate overloading. J. G. Noest (Consolidated Edison) suggested that deformation of rotor windings could be averted by running up the temperature before imposing the rotation and centrifugal stresses.

Launched also at the meeting was a proposed specification for prime mover speed governors, a joint five-year program of A.S.M.E. and A.I.E.E. under M. J. Steinberg (Consolidated Edison). Terminology has had to be agreed upon and then the provisions had to embrace all that operators want consistent with what can be made and be measured.

Conductor Loading

Safe Ratings for Overhead Line Conductors. L. M. Olmstead (Duquesne Light). Evaluates annealing, loss of strength, atmospherics, shielding, splices and connectors as bearing on maximum permissible current. Comprehensive data. Refrains from hazarding universal table.

Guide for Wartime Conductor Temperatures for Power Cables in Service. A.E.I.C. Subcommittee. Tables for normal daily and occasional emergency operation of paper, cambric and rubber insulated cables in war load service. Similar to A.I.E.E. guide presented in January.

Interim Report on Emergency Overloads on Overhead Conductors. A.I.E.E. Subcommittee.

The Effect of Corona on Coupling Factors between Ground Wires and Phase Conductors. G. D. McCann (Westinghouse). Coupling factors measured for numerous configurations; positive higher than negative polarity, both higher than previously used. Also measurement on critical flashover of rod gaps. Increased coupling found for underneath ground wire.

Frank admission was made that there was less specific knowledge on which to base the ultimate ampere-loading of overhead conductors than for cables—the variables are more numerous and elusive for the exposed conductors. On cables the technology has been accelerated, said Herman Halperin (Commonwealth Edison) to the point where U.S.A. emergency loadings are far above present prac-

tice in Britain, where copper stringency can hardly be less severe than here.

Copper of standard purity will vary tremendously in anneal-strength characteristics as to source and composition of the impurities, said L. F. Hickernell, adding that Anaconda has instituted a laboratory program to clarify the dubious points. Temperature gradients were reported by Edwin Hansson (Penn W. & P.) to be greater for homogeneous than for composite conductors. J-bolt clamps, warned W. H. Burleson (Ohio Brass), may behave well enough on large conductors, but will generate considerable heat if the gap is closed up in using them on small conductors.

Open-air conductor loadings can be too conservative if the adverse factors of load-peak, weather, solar radiation, emissivity are taken as concomitant and thereby pyramided; Philadelphia Electric, said L. R. Gaty, uses an absolute ceiling of 175 C. and a normal ceiling of 135 C. for copper. Four localities were found where 135 C. would have resulted in 66-kv. contacts.

Halperin's paper was construed by W. A. Del Mar (Habirshaw) as promising big post-war business in varnished-cambric and ozone-resisting rubber-compound cable replacement because of the high amperages suggested. He showed, on the other hand, how allowances for a.c./d.c. ratio, resistivity, emissivity, duct correction factors and a favorable ambient could justify as much as 30 percent relaxation of the admittedly conservative I.P.C.E.A. values.

The A.E.I.C. recommendation-with-caution approach was welcomed by R. J. Wiseman (Okonite) as a new approach to discreet overloading, adding that the operator is more interested in permissible amperes than in forbidden temperatures. H. L. Davis said Philadelphia failure rates nearly quadrupled when copper temperature was boosted from 77 to 100 C., but the maintenance did not exceed the capabilities of the crews; at higher temperatures the sheath cracks become progressively more vulnerable in submerged locations.

Relaying

A New High-Speed Balanced-Current Relay. V. N. Stewart (General Electric). Induction-cylinder type; operating coil relay is one cycle; quick restraining torque derived from flux-shifting lag ring. Floating circuit build-up overrides error current of first cycle.

Pilot-wire Relaying on a Metropolitan System. T. G. LeClair and **E. L. Michelson** (both Commonwealth Edison). Close-knit, short distances of generator interconnection warrant pilot-wire relaying, isolated phase system and neutral resistors to limit fault current. 218 circuits; 300 miles of cable; 6 incorrect operations in 164 in 10 years.

Distance Relay Protection for Subtransmission Lines Made Economical. L. J. Audlin (Central New York Power) and **A. R. V. Warrington** (General Electric). Phase selector relay protects all three phases by means of a single high speed reactance relay through switching it to the correct potential and current; 5-cycle operation.

Relay protection of Tapped Transmission Lines. M. A. Bostwick and **E. L. Harder** (both Westinghouse). "Three-terminal nightmare" of protection engineer discussed for utility and industrial interconnections as to directional OC, impedance (distance) and pilot or carrier relaying. Conclusion favors HCB 2-wire a.c. pilot.

Whether costs for pilot and carrier-current relaying systems cross at 10, 20 or 40 miles proved to be a moot question. LeClair and Michelson had provoked the discussion by mentioning 20 miles. But L. F. Kennedy (General Electric) asked how the corresponding cost for carrier could be three to four times the actual. E. L. Harder (Westinghouse) and C. A. Muller (Amer. Gas & Elec.) also dissented, the latter having 200 carrier terminals on 132 kv. that cost slightly under $5,000 on the average, including backup; Muller said the two were competitive around 7 miles (with carrier the more reliable for long transmission). W. R. Brownlee (Commonwealth & Southern) figured 40 to 50 mile equality. LeClair said Chicago's pilot relay costs were inclusive of housing, potential devices, etc., and a generous provision of test switches, the latter being a paying investment. Clearing is so prompt and effective that maintenance crews have trouble locating the point of fault.

Doubt about the economy of the Audlin-Warrington scheme was expressed by S. L. Goldsborough (Westinghouse), but Milo H. Pratt (Central N. Y. Power) substantiated it and called it a superior solution for the double-circuit 44-kv. line with alternately tapped substations; the phase-selection relay scheme definitely proved less costly than three distance relays. Incidentally, Pratt said engineers are going to have to muster better-than-ever arguments after the war to convince managements of the occasion for spending money for any purpose.

Lieut.-Commander W. B. Morton, U. S. Navy; H. F. Bott, United States Steel, and M. A. Faucett, University of Illinois

T. G. LeClair, Commonwealth Edison, and E. S. Kessler, Pacific Electric Manufacturing Corporation

Switching and Supervisory

Interim Report on Application and Operation of Automatic Reclosing Equipment on Stub Feeders. Committee on Automatic Stations. Summary of practice in 100 applications on 70,000 miles of circuit by 41 users shows service restoration on 73 percent of circuit miles on initial reclosure. Suggestions for improved performance and coordination offered.

Interim Report on Characteristics and Performance of Conductors for Supervisory Control and Telemetering. Subcommittee. Covers 9,000 circuit-mile-years for 189 circuits for which out-of-service time is not over 0.05 percent. Tabulation and large chart present full details of installations.

The Cause and Control of Some Types of Switching Surges. T. W. Schroeder (General Electric). Wave front steepness may exceed that of lightning surge. Discusses single-phase switching. Transformer windings can discharge opened capacitive circuit. Shunt capacitors can prevent harmful rise created by breaker opening.

Experience with Oil Circuit Reclosers on REA Systems. L. M. Moore and **B. O. Watkins** (both R. E. A.). Ratio of lockouts to operations generally under 5 percent. Failures and troubles a small percentage. Suggestions offered for improvement. New sectionalizing devices urged. Data from a large part of 800 REA's having 376,000 miles serving over 1,000,000 customers.

A New High-Interrupting-Capacity Fuse for Voltages Through 138-kv. H. H. Fahnoe (Westinghouse). Short length, rapid arc extension, no expulsion, light-weight fuse, drop-out design uses compressed boric acid as interrupting medium for 1,000,000 kva short circuits.

Circuits with rod gaps and reclosing devices will necessarily show higher percentages of successful reclosure than if not so equipped, said G. S. Lunge (General Electric); outages for such circuits will naturally be larger than and bear no definite relation to the number of true line faults. That there were three times as many breaker operations on the REA systems with gap-protected transformers was pointed out by H. L. Rawlins (Westinghouse); also gap breakdowns did not decrease during the relatively lightning-free months of September and October.

That it would be desirable to make reclosure time-delay adjustable for co-ordination with sectionalizing fuses and bring fuse and breaker-relay characteristics nearer together was the expressed opinion of F. E. Andrews (P. S. of No. Ill.)

On behalf of W. R. Bullard, it was asserted by S. H. Wright (Ebasco Services) that it was difficult to see how arresters can be justified on lines equipped with reclosing breakers; the gap-protected systems were apparently giving the better service. More reliable service, said Edward Beck (Westinghouse), can manifestly be given with the self-clearing protection afforded by the arrester or protector tube. He asked the REA authors whether future economics and service continuity requirements would be satisfied by a combination of reclosing breaker and lightning protectors costing 75 percent as much as those now standard. C. E. Mosley (Matthews Corp.) doubted whether a breaker can be made less expensive at the same time as incorporating the improvements recommended in the Moore-Watkins paper.

On the Fahnoe fuse paper A. E. Anderson asked (for C. L. Schuck, General Electric) whether an average man could handle the 15-lb. fuse at the end of a 10-ft. switchstick and not require an operating platform. L. R. Gaty (Philadelphia Electric) concurred and added that a supplementary disconnect switch would generally be indicated.

Carrier and Lightning

Application of Carrier to Power Lines. F. M. Rives (General Electric). Discusses evolution of present practices as to coupling, tuning, traps, choice of frequency. Gives new technique for evaluating attenuation. Data and circuit diagrams.

Carrier-current Differential Protection for Transformer Banks. T. A. Cramer (General Electric). For transformer tapped in high lines with only a low-tension breaker. Fault initiates carrier and 3,000-cycle modulator which overrides bias of grid of relay tube to energize hand-reset auxiliary which trips the breaker.

A Simple Method for Determination of Bushing Current Transformer Characteristics. S. D. Moreton (General Electric). Focussed on "in-phase" addition method for ratio and phase-angle. Involves use of templates in graphing the characteristic from a one-point determination.

Report on Application of Lightning Protective Devices in Wartime. Subcommittee. Conservation of materials by maximum resort to protective devices. Contains eight specific suggestions, cautions and precautions.

Frequency Modulation for Power Line Carrier Current. E. W. Kenefake (General Electric). Advantages discussed, particularly interference reduction. One-to-one deviation ratio permits making band-width same as in audio-frequency modulated channel.

In presenting the committee report I. W. Gross expressed the opinion that it is better to suffer more failures of ample protective devices than incur damage to equipments involving much critical material. On the matter of rerating and rehabilitating arresters there was some dissent.

S. H. Wright, Ebasco Services, and L. F. Hunt, Southern California Edison

R. T. Henry, Buffalo, Niagara & Eastern Power; R. C. Frenger, Westinghouse, and I. W. Gross, American Gas & Electric

T. F. Peterson, American Steel & Wire, and M. S. Coover, Iowa State College

F. E. Keith, Chairman Chicago Section, A.I.E.E.; A. Boyajian, General Electric, and J. R. Meador, Chairman Pittsfield Section, A.I.E.E.

Edward Beck (Westinghouse) questioned the propriety of removing parts to eliminate the old 5 percent margin in rating; also less critical materials are often required for proofing a line with protector tubes than by ground wire installation.

In view of the template curve proposed in the Moreton paper, W. E. Marter (Duquesne Light) asked whether curves could not also be made available for older types of core iron so that the method could be applied to older bushing transformers. C. A. Woods (Westinghouse) suggested that the method could be extended to all kinds of current transformers if a means could be devised to determine secondary leakage where it is less negligible.

High commendation was expressed for the Rives paper on carrier because it affords a needed résumé. Attenuation studies are important to avoid choice of unfavorable frequencies, said S. H. Wright in an Ebasco comment which also agreed that the paper should dissolve most of the residual hesitancy about carrier. E. H. Bancker (General Electric) says carrier started the hard way (speech transmission), but is now of age and standardized, although hardly in mass-production manner. J. C. Bowman said the Public Service Electric & Gas system has installed some 20 carrier systems (26 and 132 kv.) in the last four years.

Furnaces and Transients

A Study of Voltage Transients in Arc-Furnace Circuits. J. B. Hodtum and J. B. Rice (both Allis-Chalmers). Surges largely caused by switching. Tripping out under load can cause high overvoltages in early part of heat. Later load tripping may result in lower voltage transients than in no-load tripping. Better raise electrodes before tripping breaker.

Practical Calculation of Electrical Transients on Power Systems. R. D. Evans and R. L. Witzke (both Westinghouse). Presents a method of solving problems of transient phenomena without using differential equations or operational methods. The method is one based on the steady-state characteristics of networks.

Arc-Furnace Control by Regulex Exciters. T. B. Montgomery and T. H. Bloodworth (both Allis-Chalmers). Seven-machine motor-generator set comprises three generators and three amplifying exciters to amplify the corrective influences on respective phases of a three-phase furnace to achieve improved efficiency and reduced maintenance.

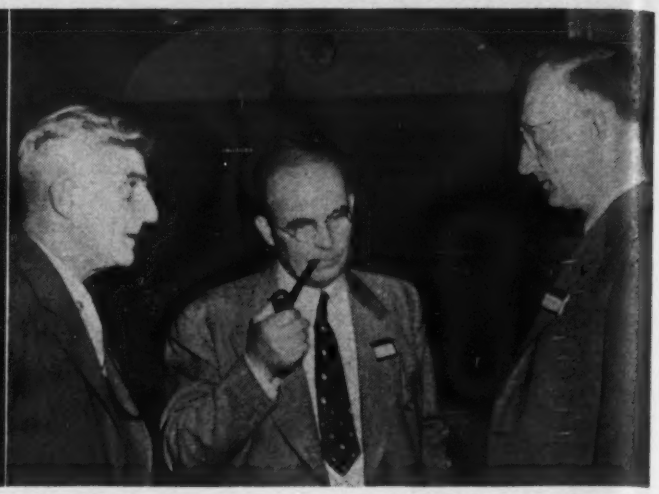
Rotating Regulator for Arc Furnaces. R. A. Geiselman, C. C. Levy and W. R. Harris (all Westinghouse). Rototrol controls electrode position in response to current in electrode and voltage between electrode and shell. Rectified voltages and currents matched against d.c. generator.

So little is known of the phenomena attendant upon the operation of a circuit breaker, said G. E. Shaad (General Electric), in reference to the Hodtum-Rice paper, that too much weight of consideration should not be given to the possible contributions to transient conditions by other elements in the arc furnace circuit. This recognition of incomplete knowledge in the premises was echoed by Lee Clarke (Detroit Edison), who related a couple of instances to prove that the causes of surges in these circuits have not yet been accurately determined. C. C. Levy (Westinghouse) doubted that the conclusions of the authors regarding the effects of arc instability were justified by the data in the paper. J. H. Hagenguth (General Electric) pointed out that the occurrence of surges in furnace circuits was really very infrequent in comparison with the large number of switch operations in normal furnace operation. E. L. Whitehead (Duquesne Light) remarked that not all troubles in furnace circuits resulted from overvoltages, but that poor maintenance and lightning were also important factors. B. M. Jones, of the same company, wanted to know if the authors' conclusion that supply system conditions might be among the causes of surges implied that the system should perhaps be changed in order to prevent overvoltages in the furnace circuit.

Discussion of the Geiselman-Levy-Harris and Montgomery-Bloodworth papers, after the offering of the amplidyne for arc control by G. E. Shaad (General Electric), resolved itself pretty quickly into an amiable argument between those who expected the rotating regulator to displace all other forms very soon and those who felt that the classic magnetically operated contact making devices were good for quite a few years yet. These latter, said C. E. Valentine (Westinghouse) can be made just as sensitive, can have as good anti-hunting characteristics, are more easily maintained and, finally, in these days of scarcity, use less of critical materials.

E. W. Henderson (English Electric Co. of Canada) commented that regulators controlling arc furnace operation are not particularly helpful

F. S. Black, Potomac Electric; R. H. Barclay, J. G. White Engineering Company, and J. H. Lampe, University of Connecticut



M. J. McHenry, Ontario Hydro; A. H. Schirmer, Bell Telephone Laboratories, and W. P. Dobson, Ontario Hydro

in supply system regulation. He instanced a small system supplying two furnaces of 2,700 kva. total demand to which revisions large in cost for the size of the system had to be made in order to provide tolerable voltage conditions for other customers.

Rectifiers

The Testing of Mercury-Arc Rectifiers. H. L. Kellogg and **C. C. Herskind** (both General Electric). Discusses vacuum tightness, degassing, dielectric, load-limit, duty-cycle, capacity, current-limit, short-circuit, arc-back, pick-up, blocking, phase-control, efficiency and wave-form tests.

Theory of Rectifier-Direct-Current Motor Drive. E. H. Vedder and **K. P. Puchlowski** (both Westinghouse). Discrete pulses assumed from grid-controlled thyratrons for analysis of peak-times, wave shapes, load-speed relation and speed-torque curves. Mathematical and charts.

Operation of Non-salient-Pole-Type Generators Supplying a Rectifier Load. M. D. Ross and J. D. Batchelor (both Westinghouse). The Pohl rating reduction factors found too large in temperature tests on 1,250-kva. generator supplying 600-volt ignitron. Stator additional rises due to harmonics small; rotor rises from 19.1 to 25.5 deg. C. for 0 to 30.4 deg. phase delay, respectively. Double three-phase operation.

Load Pickup by a Group of Ignitron Rectifiers. L. W. Morton (General Electric) and **D. I. Bohn** (Aluminum Company of America). Arc-back anode shield used as grid to block energized ignitors (a.c. and d.c. switches closed) to effect equal load division when starting a battery of rectifiers.

Thyratron Motor Control. E. E. Moyer and **H. L. Palmer** (both General Electric). Qualitative discussion of grid-controlled thyratrons and auxiliaries for phase-shifting, reversing, dynamic breaking, current limitation, field weakening, etc.

In reference to the Kellogg-Herskind papers, J. H. Cox commented that the value of accelerated test data was somewhat questionable because all of the factors involved in rectifier operation are not thoroughly known. Perhaps, said Mr. Cox, a base for rectifier load rating might be developed from the established knowledge of rectifier performance in railway service.

D. E. Marshall (Westinghouse) made a chalk talk to show how the complicated equations of the Vedder-Puchlowski paper could be reduced to graphic presentation and thus made more easily usable. G. E. Walter (General Electric) remarked that the matter contained in the paper is larger than indicated by the title and might be taken to cover the general case of combination of rectifier output and d.c. counter-voltage. The values of current in thyratron rectifier output measured by a d.c. ammeter do not indicate the true heating effect in motor armatures so supplied on account of the a.c. components in the circuit, said Walter Richter, Milwaukee. He recommended an inductance in the cathode circuit of the rectifier to limit these a.c. currents.

Conclusions of tests recited in the Ross-Batchelor paper, said R. D. Evans (Westinghouse) are reassuring to rectifier users because the tests show that the amount of heating is much less than previously stated. C. C. Herskind (G.E.) agreed that previous practice in regard to heating effects on generators with rectifier loads has been too conservative.

Discussing the Morton-Bohn paper, Herskind pointed out that the anode shield was not designed as a control grid and that for lower rectifier temperature more negative voltage is required on the shield for effective control. H. Winograd (Allis-Chalmers) instanced the established use of control grids in the multi-anode rectifier and described a thyratron tube arrangement for synchronizing grid control. The additional circuit complication was an offset against the value of the method, thought J. H. Cox (Westinghouse), and J. H. Thwaites (Canadian Westinghouse) said he did not believe the master excitation system suffered from the deficiency implied by the paper.

"As long as it works, let it alone" is the formula for successful operation of mercury-arc rectifiers as distilled out of the many words of this conference. The informal proceedings, under the chairmanship of J. H. Cox (Westinghouse), opened with four talks on large and small rectifier applications, on their cooling systems and on the harmonics in their supply and output systems.

F. W. Kramer (Carnegie-Illinois Steel) talked first on small rectifiers, those of 250-volt output. He pointed out that this class of rectifier usually was in single installation, working in parallel with rotating d.c. machines, frequently with much less than expert supervision and care, subjected often to widely fluctuating load. And with all these disadvantages, most of the troubles encountered were not with the rectifier itself, but with its auxiliary equipment.

The large rectifier is a pampered child in comparison, according to the next talk, made by L. N. Greer (Aluminum Company). It is installed in multiple units in stations of

many thousands of kva. capacity serving large blocks of electrochemical loads. It is desirable now to think about the development of standard practices of operation and maintenance since the rectifier itself is now pretty well standardized. Rectifier cooling systems was the subject treated by H. Winograd (Allis-Chalmers), who opined that the recirculating water system employing heat exchangers was about the best. There is need, he said, for improvement in methods of rectifier temperature control, on account of the effect of temperature on arc drop and on the occurrence of arc backs. L. W. Morton (General Electric) reviewed the literature on rectifier harmonics and discussed devices for reducing them, among which multiplication of phases is the best.

As was natural, in view of the comparative newness of the igniter type, experience with the multiple-anode rectifier figured more largely in the general discussion that followed the four talks. One old rectifier in daily service has not been opened for ten years; an average of seven years without opening for all of the many rectifiers on one large supply system. Poor vacuum and poor temperature control are the principal causes of backfires. Maintenance cost of rectifiers used to be about 2½ times that for rotating machines; now it is about the same. Rectifier maintenance cost, reported by one user, runs about 50 percent for tanks, 23 for evacuating systems, 9 for cooling systems, 4 for other auxiliaries, 6 for transformers and the remainder for miscellaneous.

Power for Resistance Welding

Automatic Voltage Compensator for Resistance Welding Control. E. M. Callender and R. S. Phair (both E. G. Budd Mfg.). Auxiliary electronic control maintains weld current irrespective of line voltage variations by advancing the phase of the firing voltages applied to the ignitron tubes supplying the weld energy. Permits consistently good welds on poorly regulated circuits.

Solutions of voltage regulation problems, arising from operation of resistance welders and of concern to both the user of the equipment and to the utility supplying energy for it, can be arrived at only by complete co-operation between the user, the utility, the welder builder and the maker of the control. That was the consensus reached at the conference on resistance welding and its associated supply system.

In addition to the formal paper summarized above, five conference papers presented the views of user, utility and manufacturer. C. M. Rhodes, Jr. (General Electric), described four methods—uses of motor-generator sets, of series and shunt capacitors and of direct current for the weld—for correction of power factor of resistance welding loads. H. J. Bichsel (Westinghouse) described the operation of electromagnetic and electrostatic energy storage welders, pointing out that such welders working with three-phase supply might require as little as 10 percent of the capacity needed for welding by direct connection to single-phase supply. The utility viewpoint was presented in two papers on power system supply, one by C. N. Clark (Duquesne Light) and the other by C. J. Firth and L. R. Gaty (Philadelphia Electric). These papers put major emphasis on two requirements for satisfactory service to the welder user and to other customers in the immediate area, adequate data on welder characteristics to be furnished by the welder maker and notice to the utility before the user puts the equipment into operation or, better still, before he buys it. The fifth paper, by B. L. McArdle (United Steel & Wire) set forth the user's angle in reference to the application of series capacitors to welders in production of air field landing mats.

Conference on Induction Heating

It appears that, if expense is no object, practically anything that needs to be done in this world can be accomplished by induction or electrostatic heating, and that an impressive list of things can be accomplished by them much more economically than by any other means. This was the impression to be taken from talks at the conference on induction heating by Messrs. H. B. Osborn (Ohio Crankshaft Co.), P. D. Zotter (Girdler Corporation), J. P. Jordan (General Electric) and H. C. Madsen (Westinghouse). It was a little confusing to some in the audience when Mr. Osborn referred to high frequencies of 10,000 cycles and Mr. Zotter spoke of low frequencies in the order of one megacycle. The talks, accompanied by slides and motion pictures, were more descriptive than expository of phenomena.

L. M. Moore and M. W. Rothpletz, Rural Electrification Administration

R. W. Sorensen, California Institute of Technology, and C. R. Jones and L. W. Chubb, Westinghouse

PRIORITIES PROBLEMS

Turbine Repair Parts

Case No. 71

Electric utilities rank with the leaders in the matter of automatic ratings for maintenance and repair materials, and in general the AA-1 rating automatically assigned for this work by order U-1 is sufficiently high to get what's needed—and on time. In some cases, however, the AA-1 will not get the necessary material soon enough to do the job. For the particularly vital business of keeping turbines in operation, OWU has instituted a procedure to make certain that utilities get what they absolutely must have to continue service.

The workings of this procedure are exemplified in the case of a utility which notified OWU that it needed new turbine blading and was unable to get sufficiently quick delivery by the use of the AA-1 rating extended for this purpose by U-1.

OWU's first step was to check the over-all power supply picture of the region in which the company was located. The Power Supply section of OWU was consulted to determine whether the generator operated by the ailing turbine was absolutely needed to carry the load or whether it could be left off the line for a sufficiently long period to allow shipment of the needed blading under the regular AA-1 procedure. The survey determined that it was out of the question to leave the machine idle for the time necessary to make the repairs under this procedure.

OWU's next more was to study the schedule of the manufacturer who would be called upon to supply the blading in an effort to determine how much delay would be imposed on construction schedules of shipping programs if the utility's order were inserted into a schedule ahead of other orders. With this knowledge and the exact status of the regional power supply situation in hand, the decision on just how to handle the company's request was made. It was decided, in view of the tight power supply in the company's region, to issue an AAA rating, which was issued by WPB's Special Ratings Branch and forwarded telegraphically to both the applying company and to the supplier.

In not every such case will an AAA rating be granted, however. If the regional power supply picture is not so tight as in the case at hand, OWU may direct the utility needing turbine repair material to buy power from a regional source until such time as it can get the necessary materials under its automatic AA-1 MRO rating. Or it may direct another expedient to tide the utility over until such material becomes available under an AA-1 rating. Conceivably the company may be advised to remove blades opposite the broken blades to balance the machine and operate it at reduced output.

OWU emphasizes that companies which find themselves in a position such as the one here described should immediately issue an order for the needed material or reserve a purchase order number, even before sending an application to OWU. All applications for higher ratings should be accompanied by this purchase order number and an exact description of the material needed. This information is needed by OWU in determining how to handle the situation, and if it accompanies the application to Washington the application obviously will receive that much faster treatment.

Utilities faced with a possible need for a special rating to get vital turbine parts quickly should submit the following data to OWU as rapidly as possible, preferably with the original application. Special ratings cannot be issued without this information, so companies which submit it promptly will aid their own cases. Necessary material includes:

1. **Purchase order number and date.**
2. **Supplier's name and address.**
3. **Exact description of necessary material or a copy of purchase order.**
4. **Dollar value of the material.**
5. **Delivery date requested and the effect on the company's production if it is not met.**
6. **Delivery promise by supplier under rating presently available.**
7. **Other potential sources of supply investigated aside from the company from whom the material is finally ordered.**

Reporting Inventories on Form UF-14

Case No. 72

Form UF-14, as the vehicle on which electric operating companies report quarterly their actual deliveries, withdrawals and inventories under order U-1, is one of the principal means by which the Office of War Utilities collects the information it needs to carry out its wartime conservation program.

As such, OWU is somewhat alarmed over the numerous mistakes which utilities have made in reporting on UF-14. Most of these errors are to be found in columns (g) and (h). Column (g) should list the actual inventory on hand up to the figure allowed under U-1 as practical working minimum inventory. If the actual inventory, by control classes, is less than that allowed by U-1, that part of the amount actually on hand which is necessary for safe and effective operation is to be listed in column (g). The remainder of the inventory actually on hand should be listed in column (h). If the amount on hand exceeds the allowable PWM for the control class in question, then the amount of inventory in that class allowed as PWM should be listed in column (g) and the remainder should be listed as excess in column (h). In no case should any inventory be listed as excess in column (h) unless it actually is on hand. Red figures should never appear in column (h).

OWU has found that many companies erroneously list in column (g) the amount of inventory, by control class, which they are allowed under U-1. Since the amount of inventory allowed by U-1 will only rarely coincide exactly with the amount of inventory actually on hand, OWU must conclude in such cases that the report has been improperly made.

One company, for example, calculated its allowable PWM in the

transmission and distribution class at $12,000, which was four-thirds of the amount used in that class in the last nine months of 1942. It listed $12,000 in column (g). Actually it had on hand only $10,000 inventory in this class. To account for this discrepancy, it listed $2,000 in column (h) as excess. To complete the error, it listed the excess in red figures.

Another error was the following: PWM authorized by U-1—$12,000; actual inventory on hand at the close of the quarter, $14,000. The utility reported $14,000 in column (g) and none in column (h), both of which entries were wrong. The allowable PWM, $12,000, should have been listed in column (g) and the remaining $2,000 in column (h) as excess.

In some cases utilities added their totals for class 2, 3, 4, 5 and 6 together and reported the sum on line 38, "other materials and supplies." This total was then added to the total for class 7 to arrive at the figure asked for in line 39, "total, all classifications."

The amount to be reported on line 38 is all inventory other than that listed in classes 2, 3, 4, 5, 6 and 7.

Another case of too literal interpretation of U-1 resulted in the listing, in column (g), of an inventory of $10,000, the amount actually on hand, in transmission and distribution equipment. During 1942, the company had, under Order P-46, been allowed $8,000 inventory in this control class, and the remaining $2,000 had been listed as excess. The bookkeeping change was made when the substitution of Order U-1 for P-46 gave the company an increase in allowable OWM for this class. If the company could get along on the $8,000 inventory allowed it in 1942, it should continue to do so under U-1, and should continue to list the $2,000 as excess, despite the fact that under U-1 it was allowed a $10,000 PWM. This voluntary adoption of a less-than-maximum inventory will conserve critical materials even beyond the point ordered by U-1 by making available as excess equipment items which otherwise would have to be ordered from manufacturers.

Under U-1, OWU does not have to allow utilities as much PWM in any control classes U-1 allows if OWU feels that the company can operate safely and effectively with less. On several occasions, where companies have applied for authorization to exceed the provisions of U-1, study of past reports has indicated to OWU that not only is there no justification for permission to exceed but also that there is no real reason why the company cannot get along adequately with less inventory than U-1 allows. In such cases, OWU has negotiated for a reduction in the allowable inventory.

Rx PREFERENCE RATING assigned by Paragraph (e) (1) (i) of Order U-1 may be assigned to orders for controlled material from another utility under the provisions of the inventory redistribution program. Inasmuch as Paragraph (i) (1) requires a rating of AA-5 or better on sales by utilities from inventory, and inasmuch as new controlled material allotments include no preference rating, the rating automatically assigned in (e) (1) (i) must be used. The certification should be copied in full.

Extending Project Authorizations

Case No. 73

Normally utilities which receive project authorizations on Form PD-545 can complete the allowable work within the 90-day period for which the authorization has been ruled to be valid. In some cases, however, work may not be completed in this time and, occasionally, not even started, in which case the validity of the authorization is in question.

A utility which had been unable to complete an authorized job within 90 days wrote OWU asking where it stood. It pointed out that all the ratings issued had been extended and that all material for the purchase of which the ratings had been issued had been received. Work was about half complete.

OWU notified the utility that inasmuch as work had actually been started it could complete the job without further authorization. Had no work been started, however, the company would have been required to resubmit the project on form PD-545 or WPB-2774 for a reappraisal of its essentiality. This requirement would have applied whether the ratings issued under the original authorization had been applied and whether the material they called for had actually been received.

Normally, when such reauthorization must be obtained, WPB will allow the project to go ahead as originally authorized. There are cases, however, in which such reauthorization would not be forthcoming.

Had the company, without any good reason for doing so, delayed the job to such point that its authorization ran out, OWU would have been inclined to question its essentiality and to re-examine the project minutely to determine whether it was a "must." Or, if the standards on which the project originally was authorized had been changed radically, or to such an extent that a similar project would not now be authorized, it is possible that no reauthorization would be granted.

In the event that such reauthorization might be denied a utility which already had acquired some or all of the materials for the job, those materials would be put into inventory in the same fashion as materials left over at the completion of authorized projects are put into inventory. If such additions to inventory were to be in excess of allowable minimums, such materials would go into excess inventory.

Rx THERE ARE TWO PROCEDURES by which utilities obtain entrance cable for the connection of electric ranges. The difference between them lies in the ultimate ownership of the cable. Normally, the range owner will buy the cable from the utility which installs it. Where the customer is to take title to the entrance cable extending from the meter to the range the utility may sell the cable to the customer without rating. If the utility wants to maintain its supply of entrance cable, however, it may require the customer to make application for a rating to purchase entrance cable. This application will be made to the nearest WPB office on Form PD-1A, and, when issued, turned over to the company, which will extend it and replenish its own supplies. Should the utility choose to retain the cable, it would get its stocks under Order U-1 as operating supplies, using the rating assigned in paragraph (e) (1) (i), provided the order were under $500. If the order were for more than $500, a letter application for authority to purchase would be necessary. In neither case would a rating be required of the customer.

Editorials

S. B. WILLIAMS, *Editor*

More Seed Money for Utilities

FOLLOWING closely on the heels of the Pennsylvania Commission, the New York State Commission has, in connection with the authorization in two instances to retire preferred stock, cautioned utilities to husband their cash as a preparation for post-war needs and not disburse it in larger dividends and high salaries.

Every indication points to a considerable expansion and rehabilitation of utility plants in the first five years after the war. At the same time there are going to be large demands for financing by others. Sound business dictates that the more utilities can finance their own requirements the easier and less expensive will it be.

Because of limitations in the materials market, certain expenditures that normally would be made are not being made. This gives a fictitious improvement in earnings which, if not put aside for the purposes they would have been spent for, may bring post-war difficulties.

By recognizing this situation two important commissions are now on record as favoring a "seed money" program for utilities. This is intelligent regulation. It is hoped that other states will follow.

Selection of Load Dispatchers

THERE APPEAR to be two schools of thought on the matter of discovering and selecting men who have the peculiar characteristics that make for trustworthiness and alertness in a load dispatcher. One school relies on personal interviews and the intuitive ability of the interviewing official to pick the men with the proper personality, intelligence, alertness, memory, visualization capacity and mechanical grasp that must be present along with qualities that make for general acceptability as an organization man.

Another school believes in supplementing this with an appreciable amount of objective testing of the candidate or prospect. So many of the distinctive characteristics desired are semi-qualitative in nature as to render the mere judgment of the interviewer subject to error in decision and consequences. Does the man have ability to plan, is he logical in analysis, does he have supervisory ability, is he a team-worker, practical, aggressive, versatile, unemotional, able to digest sequences, fearless in emergency? Previous experience is one factor relatively easy to ascertain, but even there there is a question whether it has built up the desired attributes.

Intelligence of a general nature is not always accompanied by the mechanical intelligence needed to cover the intricacies of electrical apparatus and complications of system interconnection. Dozens of tests have been devised since the IQ and Army Alpha paved the way toward eliciting these intelligence aspects. Many more have been devised most ingeniously to ferret out the candidate's abilities in qualitative personnel directions. College psychology departments have explored this field and lists of tests and books are available which enumerate 50 or more covering alertness, screening, "personal audit," temperament scales, reaction times, mechanical comprehension, dexterity, spatial perception. Among them are a few that have especial electrical significance.

Thus there is no dearth of background for any utility that wants to supplement the mere interview method with objective tests that add a scoring feature. Regardless of other merits, the tests do help show an actual or prospective system operator whether he himself has or lacks the aspect of mental or temperamental nature. Furthermore, the aptitude and intelligence tests can even be used effectively in stimulating study on the part of existing dispatchers to correct any defects which the tests bring to their attention.

Ellis Captures REA

REA ADMINISTRATOR SLATTERY apparently has won his fight to prevent co-ops from lending to the National Rural Electric Co-operative Association the funds necessary to start its mutual insurance project, but at what cost? For daring to protect the government, Slattery is no longer boss in his own house.

It is now said, and probably for good reason, that NRECA in the person of Manager Clyde Ellis is the new boss. His ability to swing political support, even to the extent of "getting" an old member of the Administration family, puts him in a position where no REA move of any importance will be made without his knowledge and approval.

All of which means that REA is now definitely in politics. Congress decreed that REA was for the purpose of extending electric service into unserved rural areas, but Ellis declares it shall be for the purpose of absorbing the "big bad wolf" (private power industry). The Rankin bill, to make this a fact to the tune of 100 millions a year, is very much alive. If that passes the spoils of the

bsorptions will remove all desire to take care of the nserved farmer.

Ellis has won the first round—he has captured REA. Will he be strong enough to win from Congress the reatest political spoils of the age—the purchase of rivate utilities and the patronage that goes with it? his is big stuff and Ellis is no piker.

Commercial Equipment Bound o Reflect Aircraft Design

LECTRICAL EQUIPMENT for military aircraft manistly is going to set the pattern for many significant dvances in more ordinary forms of electrical equipent when the war is over. The electrical systems are izable in rating because there are so many things to e actuated and operated electrically—engine starter, ynchronizer, propeller pitch control, wheel retractors, uel transfer, gun firing, turret operation, bomb release, lap control, heating, bomb sights, lighting. Admittedly he requirements for bombers and fighters are extreme, nd so are the conditions under which the humans and he equipment have to function. Temperature from almost oiling on the ground to —50 deg. F. of stratosphere igidity, terrific vibration and acceleration (ten times ravity), wide range in barometer pressure and humidity re just part of the problem.

Most pressing of all is the imperative demand that eights be kept down to extend range and "pay" load. very pound of avoidable weight is said to require nother pound of structure and fuel to carry it. Every 00 watts of unnecessary loss uses up a pound of fuel n a ten-hour flight and a pound of fuel is often enough o take a plane a half-mile.

The combined influence of pressure to reduce weight rastically and to improve efficiency has resulted in easures which cannot help having an influence on the esign of comparable equipments for peacetime pursuits. ven the short life which can be tolerated may well odify thinking on the balance between cost, maintenance, life and efficiency of commercial devices.

Weights for rotating machinery are already down o a tenth or less of industrial equipments of comparable ating. This has been achieved by going to higher eeds and frequencies, by using better quality iron, by king advantage of the unlimited supply of cooling air, y using glass and mica insulations and new varnishes at can stand temperatures of 200 deg. C. or better. here are companion innovations in the fields of transrmers, rectifiers, conversion units, contactors, circuit eakers and switches. The bounce problem in contactors d commutator brushes has been a critical one, but fully solved.

No piece of electrical equipment on an airplane has caped attention in this effort to conquer wholly new oblems. The ingenuity of design and cultivation of new materials which overrode all those challenges will not fail of translation into more orthodox realms of electrical application.

Electro-Agriculture Needs Joint Action

MANY EYES are turning now to farm electrification as one of the markets offering great post-war possibilities. In the past the extension of service to rural areas has been made possible very largely through the desire of the farmer's family for modern lighting and household conveniences. Today, however, the farmer sees electricity as taking the place of the hired hand and as an instrument for improving the quality and quantity of food production. This commercial application of electricity to the farm or electro-agriculture, therefore, is expected to be the big rural post-war activity.

There is much, however, to be done before this industry can supply the commercial farm market properly. It is not enough to replace a flame with a coil of resistance wire or an engine with an electric motor. Why should the limitation of older methods be carried forward into electrical farm equipment? Why shouldn't the new be as efficient as is possible with electrical means?

Today virtually every agricultural college, as well as a great many specialists elsewhere, is designing electrical farm devices. Are they all equally good? When one sees the hundreds of designs for dehydrators, it is obvious that the designers of most of these started without benefit of certain fundamentals that are necessary to sound design.

It is true that the average farmer is handy with tools and through force of circumstance has had to become a jack of all trades. For that reason we see him building a great many farm devices using electricity for heat or power. Can these devices, generally speaking, be as good as soundly designed and manufactured equipments? And considering time and maintenance and efficiency, can they be as cheap?

Here, then, obviously is an opportunity for co-ordinated planning by the electrical and agricultural engineers and the electrical and farm equipment manufacturers. If this market is to grow without confusion, it must have equipment wherein the design has co-ordinated good engineering with modern farm practice.

The farmer, as history will show, has always been willing to change his methods, but he first wants facts. He wants to be sure that he is not gambling his entire year's effort on somebody's hunch. He has learned to accept the standards developed by professionals.

He will accept readily electrical equipment manufactured according to standards jointly arrived at by the recognized authorities in the electrical and agricultural engineering and manufacturing fields. Such a joint activity cannot get under way too soon.

Washington Comment

By RICHARD N. LARKIN, *Washington Correspondent*

Ellis Gets Slattery's Scalp

June 23, 1943

To all REA section and division heads and members of the Administrative staff:

1. William J. Neal has been appointed deputy administrator of REA.

2. Effective immediately, Mr. Neal will exercise co-ordinating and administrative authority for the operation of REA. All section and division heads and members of the administrative staff will report to the administrator through Mr. Neal.

3. All previous memoranda are suspended to the extent that they confiict, or are inconsistent with, the provisions of this memorandum.

CLAUDE R. WICKARD,
Secretary of Agriculture.

USING this administrative order as a knife, the National Rural Electric Co-operative Association has snatched the scalp of REA Administrator Harry Slattery, whom it has been stalking for months. Today the $64 question is:

To what extent will NRECA run REA?

Whether Slattery chooses to resign or to live out his remaining six years as REA administrator seems now to be academic. REA, it appears, will for some time to come be run through Neal, whose appointment NRECA's latest bulletin terms "most acceptable." The New Hampshire co-operative of which Neal is president, the bulletin adds, is a member of NRECA.

Another $64 question, which appears to be tied intimately to the foregoing, is this:

Has NRECA dropped out of the insurance business (ELECTRICAL WORLD, June 5, page 12, July 3, page 3) *until such time as it can finance its two companies other than by loans from co-ops?*

The answer to this question seems to be that it has. NRECA refused to answer the question. But it is common knowledge, verified in several informed quarters, that NRECA has for some time been playing down its insurance activity. There has been noticeable slackening in NRECA's insurance sales efforts. The bald statement is made that NRECA has advised several co-ops whose insurance is soon to run out to renew their existing policies.

One explanation is that a deal was made, whereby NRECA bowed to the inevitability of government disapproval of co-op loans to its two insurance companies. In return, NRECA got Slattery's scalp, which had been its target since last April, when Slattery advised co-ops to await an opinion on the legality of such loans. Slattery, it appears, has been by-passed by Wickard in much the same fashion that Wickard was by-passed some months ago by the President, who brought in ex-Food Administrator Chester Davis to run the War Food Administration.

One Agriculture Department official took a milder view of the order. He argued that the by-passing of Slattery had been accepted practice while Robert B. Craig, who resigned June 1, was deputy administrator. It was only to give official status to established practice—for the benefit of the new deputy—that the order was put on paper, he said. It was recognized that the order would be interpreted as an attempt to force Slattery to resign and, in any event, to tie his hands, the official went on, but the decision was to put the order in writing anyway.

The decision to put the order in writing regardless of its interpretation seems only to mean that Agriculture foresaw and accepted the general verdict that it has purged Slattery. Since Slattery is a Presidential appointee, it seems logical that the move had White House approval.

Visiting Washington in mid-June, Slattery told a correspondent he expected to be summoned to the White House and dismissed. But the President almost never fires an appointee. Normally he accepts resignations, kicks the doomed officeholder upstairs or erects another layer of authority over or around him. Thus the Wickard order appears to be more in character than a blunt dismissal.

It would have been hard to dismiss Slattery outright. He was appointed head of REA from the assistant secretaryship of Interior, a move which normally would be a step-down. He was given a ten-year term, the longest given any REA administrator. He had a long record as a conservationist and public power crusader, dating in federal service from the days when Gifford Pinchot sold conservation to an earlier Roosevelt.

Slattery, after four years as REA administrator, has a broad friendship among REA members.

Clyde Ellis, executive manager of NRECA, is a newcomer to the public power game. He was merely "on record" for public ownership before last January when he left Congress and caught on with NRECA. Spearhead of NRECA's bitter attack on Slattery, Ellis is hardly as intimate with REA co-ops and their members as Slattery. He appears, on the strength of the opinion requested by Slattery, to have guessed wrong on the legality of co-op loans to insurance companies. Yet he has defeated Slattery in the fight for control of REA, and this brings up a third question:

Since REA was intended to be non-political, and since it is so dear to most Congressmen representing rural districts, and since NRECA is so avowedly political, why is the Administration allowing it to slip into NRECA control to the extent that it has?

The best available answer to this question came from a federal official who declined to be identified:

"The future of REA," he said, "is in the laps of the gods. I don't know why some things are going the way they are, and I don't know exactly what is going to happen, but I do know there is power politics in this thing in a big way."

Slattery may or may not resign. Wickard may or may not order restitution of funds already advanced the two insurance companies by co-ops. Beyond these points, NRECA seems ready to take over.

NEWS OF THE WEEK

Conservation Program to Be Presented July 14

"Task committee" to reconvene to prepare definite recommendations for industry program — Standards for domestic and commercial energy use anticipated together with advertising drive

A program on which the electric utility industry can co-operate in a broad conservation campaign is being readied for presentation to the industry July 14.

"Task Committee" Meeting

Much of the program was threshed out last week in a two-day session of the "task committee" appointed by OWU Director J. A. Krug. The task committee will reconvene July 13 to prepare a definite set of recommendations for the industry's program. It is anticipated that these will be ready to be presented to the July 14 meeting of the informal industry advisory committee, which on June 8 agreed to OWU's suggestion that conservation be achieved voluntarily rather than through a mandatory "brownout" (ELECTRICAL WORLD, June 12, 1943, page 83).

Task committee members were pledged not to divulge proceedings of last week's meeting and OWU declined to publicize it on the basis that no definite program had yet been agreed to.

Last Tuesday the War Production Board met to act on the over-all conservation program aimed at effecting all possible savings of fuel, energy and manpower. The utility program will be a part of this drive.

In some quarters it was anticipated that the WPB meeting would see the announcement of an unequivocal endorsement of the campaign by War Mobilization Director James F. Byrnes.

It was generally anticipated that OWU's program would call for a truly intensive advertising and public relations campaign. This would be nationwide and carried on by all companies and federal agencies concerned with the generation, distribution and sale of electric energy. Unquestionably the program will contain a set of standards for the use of electric current to which domestic and commercial consumers will be asked to conform. In view of the past insistence of OWU that there is no power shortage in the United States, it is to be expected that this fact will be played up in the campaigns. The advertising campaign undoubtedly will take essentially the same tack as that sponsored recently by OWU (ELECTRICAL WORLD, May 15, 1943, page 73), except that the slogan "Waste in War Is a Crime; Don't Waste Electricity" probably will be strengthened to "Conserve Electricity," or some other slogan going beyond the idea of merely curtailing wasteful uses.

William A. Lyons, chief of OWU's Fuel and Allocations Branch, is chairman of the "task force" committee. Other members are C. W. Kellogg, Edison Electric Institute; H. P. Sedwick, Public Service Co. of Northern Illinois; Arthur Goldschmidt, of the Interior Department's Power Division; H. C. Blackwell, Cincinnati Gas and Electric Co.; Walton Seymour, Tennessee Valley Authority; E. F. Scattergood, Los Angeles Bureau of Light and Power; Charles A. Collier, Georgia Power Co.; Philip Sporn, American Gas & Electric Service Co.; Carl H. Recker, Ebasco Services, Inc., and Ralph Moody, Union Electric Co. Herman Russell, Rochester Gas & Electric Co., was unable to accept membership, but a substitute named by him was accepted by OWU.

INVENTOR HONORED—Frank H. Shaw (right) president of the Shaw Insulator Co. and inventor of a plastic molding process which permits war production of many intricate parts, was recently presented with the annual John Wesley Hyatt award for distinguished achievement in plastics. Presenting the award is Dr. Per K. Frolich, president of the American Chemical Society

Fourth Generator in at Parker Dam

Installed capacity at the Parker Dam power house has reached 115,000 kw. with the addition of a fourth generator, Interior Secretary Harold L. Ickes has announced. Power facilities were completed "ten years ahead of schedule" to meet war needs.

SIMULATED TRANSFORMER FIRE—Oil overflowing the partially open top of an oil-filled transformer tank was ignited in recent Momee, Ill., tests by the Cardox Corporation. Resulting fire burned two minutes 15 seconds (left) before a mass discharge of CO_2 was released through four nozzles at 13 ft. level, four at 9 ft. level and four nozzles around the diked area. The discharge (center) continued for one minute 15 seconds to put out the fire and cool oil below ignition temperature (right). Weight of CO_2 used was 5,850 lb.

Probe Brazos River Power Resale Deal

Following the lengthy and much-publicized investigation of the transactions leading up to the sale of the San Antonio Public Service Co., a Texas Senate committee recently opened a probe of the finances and contracts of the Brazos River Conservation and Reclamation District. The district operates the Morris Sheppard (formerly Possum Kingdom) Dam.

Principal point brought out was that the district, following a WPB directive, turned down a contract to sell electric power to a private utility (Texas Electric Service Co.), for an average of $306,000 a year, and entered into a 25-year contract with the Brazos River Transmission Electric Co-operative under which the co-op's annual payments amounted to $204,000. The co-op, in turn, sold the power for $414,000 annually, of which some $300,000 came from Texas Power & Light Co. Failure to contract with the privately owned utility originally, witnesses charged, has cost the district some $405,000 in two years.

"Motivating force" behind the resale of the district's power by the co-op, according to George Chance, chairman of the BRCD board, was the wartime demand for electric energy. The board originally turned down the offer of the privately owned utility, it was said, because the "chances of securing federal aid for other projects (Morris Sheppard Dam was built through a WPA grant of $4,000,000) would be materially reduced if not utterly destroyed" if the power were sold to private companies.

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Anchorage Bill Signed

The President has signed a bill authorizing the city of Anchorage, Alaska, to issue not more than $1,250,000 worth of bonds for the purchase of the generating plant of the Anchorage Light and Power Co., Inc. (ELECTRICAL WORLD, January 23, 1943, page 128).

NEWS BRIEFS

CHICAGO WOMEN are learning how to preserve the produce of their victory gardens for the months to come in a series of wartime canning classes recently inaugurated by the home service division of Commonwealth Edison Co. in co-operation with the consumer information service, Office of Civilian Defense. The sessions are conducted by the utility's home economists, admission is free, and the classes cover all phases of home canning from the selection of produce to storage of the finished product. Written instructions and recipes are also distributed.

THE GOVERNMENT OF SOUTHERN RHODESIA is formulating plans for damming the Zambesi River at the Kariba Gorge to create a giant irrigation and cheap power project, according to a recent British broadcast.

IN RESPONSE TO AN APPEAL by Easy Washing Machine Co. for men 65 years or older to help relieve the manpower shortage, Willard R. Walker, 73, inventor and producer of America's first household electric dishwasher, sold to General Electric in 1928, went back into harness.

SHOOTING HIGH TENSION insulators on the Green Mountain Power Corporation's lines in Vermont has become an ultra-hazardous sport (or worse) through the utility's posting of a $100 reward for information leading to the conviction of anyone engaging in this form of target practice or otherwise damaging the company's electrical equipment. The offense, because of its injurious effect on war material production, carries a maximum federal penalty of $10,000 fine and 30 years' imprisonment and a maximum state penalty of $10,000 fine and 10 years behind the bars. The FBI is investigating recent damage to insulators on this system, a part of the New England Power group.

A TRUCK-TRAILER COMBINE, carrying explosives to an army camp, crashed into a power pole in Grant's Pass, Oregon, recently, bringing a 4,000-volt line down on top of the cab. Linemen removing the wire said most of the town would have been wiped out if the truck's cargo had exploded.

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Would Suspend "Death Sentence"

A resolution to suspend until one year after the end of the war all actions under Section 11 (a), (b), (c) and (d) of the Holding Company Act has been introduced in Congress by Rep. Lyle H. Boren, Oklahoma Democrat. Pending actions are included.

The resolution was referred to the House committee on interstate and foreign commerce. It would also: (1) Extend until one year after the close of the war the time for compliance with any order, issued prior to passage of the resolution, under subsection (b) of the holding company act. (2) Suspend until one year after the close of the war all "orders, proceedings, studies, examinations or requirements by the Federal Power Commission for or relating to the reclassification of accounts of any public utility as defined in section 201 of title II of the holding company act, as such accounts existed January 1, 1937."

The resolution would not apply to projects licensed under provisions of part I of title II of the holding company act. The resolution defines the end of the war as the time when the President shall proclaim the emergency ended. The suspensions proposed would be in effect one year thereafter or until terminated by a concurrent resolution by both houses of Congress.

Federal Agencies Appeal Asks New Pepco Rate Cut

OPA and Treasury Department ask court to set aside utility commission's $311,000 rate reduction order — Public Buildings agency demands FPC investigation of rates to Pentagon Building

Two federal agencies filed appeals with the District of Columbia Court last week asking that a Public Utilities Commission order cutting rates of the Potomac Electric Power Co. by $311,000 yearly be set aside in favor of a $2,000,000 annual rate cut for which four federal agencies campaigned unsuccessfully earlier this year.

PBA Adds Voice

A day earlier the Public Buildings Administration revealed that it had asked the Federal Power Commission to investigate the reasonableness of rates charged by the Braddock Light and Power Co., a Pepco affiliate, for service to the War Department's huge Pentagon Building, across the Potomac River from Washington in Arlington County, Va. PBA alleged that Braddock's rates on current generated by Pepco were 30 percent above those which would apply if the building were in the city and could be served directly.

Appeals from the PUC decision (ELECTRICAL WORLD, May 8, 1943, page 6) were filed by the Office of Price Administration and Economic Stabilizer Fred Vinson and by the Treasury Department's Procurement Division. It was the second time this year that OPA has appealed a PUC decision. Some months ago, OPA appealed a PUC order granting an increase in the rates of the Washington Gas Light Co. The order was set aside in District Court and is now before the court of appeals.

OPA's appeal asked that Pepco be prohibited from "collecting rates and charges which are excessive and unlawful, from unjustly and illegally enriching itself" under rates ordered by the PUC. It argues that if the commission's errors were to go unreviewed and uncorrected, "erroneous conceptions" of public utility and regulatory agency obligations might go unchallenged, thus jeopardizing the stabilization program in the public utility rate field.

It argued further that, bound by the narrow provisions of the sliding scale agreement under which Pepco's operations have yielded yearly rate reductions since 1924, the PUC was unable to go into issues which the intervening federal agencies fetl must be examined to determine reasonable rates. It was also contended that while the PUC allowed for rate purposes only the provisions of the 1941 Revenue Act, it had improperly calculated the rate reduction on that basis.

Treasury's Argument

The Treasury appeal attacked the PUC order as "illegal, arbitrary and capricious," and argued that: (1) The commission "illegally made an allowance for depreciation expense in excess of $571,434." (2) The commission failed to use its own standards in determining annual depreciation. (3) The commission failed to deduct accrued depreciation from the rate base. (4) The commission allowed depreciation on non-depreciable property. (5) The commission illegally allowed $3,744,109 as working capital and $1,695,712 as federal income taxes.

In response to PBA's complaint on overcharges for Pentagon service, Pepco pointed out that it had invested approximately $1,000,000 in facilities charges to carry out the contract. It added that service conditions result in a low annual load factor, with the heaviest use coming at the peak periods. Current is supplied the Pentagon at "appreciably less than 1 cent per kw.-hr. and at less than the estimated cost when the contract was entered into," the company statement declared.

PBA claimed that the average charge for Pentagon service is 0.80 cent per kw.-hr., and that if service were furnished by Pepco on schedule "P" the charge would be 0.62 cent. The alleged yearly overcharge of $150,000 will pay for Pepco's facilities to serve the building in four years, it was added.

The matter was referred to FPC under the President's October 22 "cheapest power" directive.

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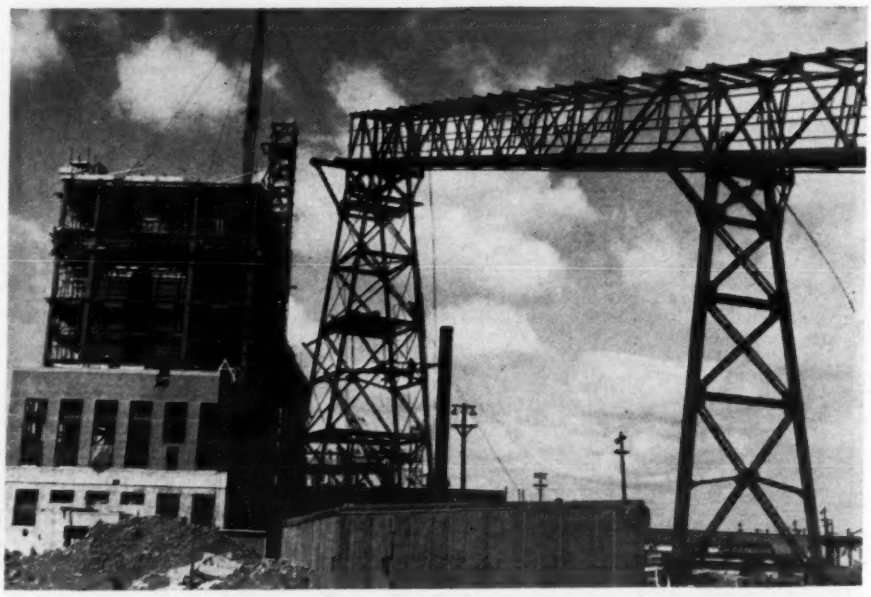
Initiative No. 12 To Go on '44 Ballot

Referendum No. 25, proposing to refer the public power initiative No. 12 to the voters of the state of Washington, will be placed on the 1944 general election ballot, Secretary of State Belle Reeves states. The referendum contained 127,303 signatures, with only 30,000 legal signatures required. Thus, should a mortality of 76 percent ot the signatures occur, the initiative still would go on the election ballot.

Initiative No. 12 would authorize public utility districts to combine for the purpose of taking over the entire properties of privately owned power concerns.



FUEL PATHWAY—Framing of coal conveyor at Boston Edison's new steam plant on Mystic River, near Everett, Mass., forms striking silhouette against the sky as construction advances on this important station

Asks Probe of Pressure Group Influence on REA

Shipstead resolution, aimed at National Rural Electric Co-operative Association, would investigate organization and financing of political groups exerting influence and control on federal agency

Aimed at the National Rural Electric Co-operative Association, a resolution to investigate the administration of the Rural Electrification Administration to determine whether political groups have been organized to influence conduct of REA has been introduced by Senator Henrik Shipstead, Minnesota Republican.

Would Review Influence

The investigation would be made by the Senate committee on agriculture and forestry or any subcommittee thereof. In addition to investigating formation of political groups to influence REA the committee would:

1. Investigate the organization and financing of such groups.
2. Review what efforts such groups have made to influence REA administration.
3. Determine whether REA administration has suffered as a result of its incorporation into the Department of Agriculture.
4. Decide whether REA should be restored to its original status of an independent agency responsible only to Congress.

Preamble of the resolution points out that REA co-operatives "should be and must be encouraged to become free from political or governmental controls as rapidly as possible," that Congress "set forth its policy of protecting REA from political influences and controls" and that "evidence at hand supports the belief that groups have been organized and supported from government funds to engage in activities intended to influence the Congress and other government agencies, and which activities are declared to be in violation of the letter and spirit of the Rural Electrification Act."

•

Unfilled Wire, Cable Orders Invalid July 1

Rated orders for wire and cable which did not carry allotment numbers became invalid July 1, when the Controlled Materials Plan went into effect on a mandatory basis, the Electrical Wholesale Distributors Industry Advisory Committee was told at a recent meeting with WPB officials.

The cancellation affected orders unfilled on that date. Not affected were orders for warehouse replacement stocks which, under CMP, can be obtained without allotment numbers. Wire and cable manufacturers have been directed to set aside for warehouse delivery certain percentages of their output.

WPB officials asked the committee to encourage in the industry a campaign to promote conservation of electrical appliances, particularly irons, which are becoming more and more vital as laundry service is curtailed.

Warn on Post-War Glut

The committee asked that steps be taken to locate and redistribute electrical materials and equipment now lying idle in various government projects. It asked further that plans be laid now for orderly disposal of government-owned surplus electrical equipment. It emphasized that everything possible should be done to prevent a recurrence of the market glut which followed the last war when surplus federal stocks were thrown on the market to disrupt normal distribution machinery. Committee cooperation in establishing a plan to prevent this recurrence was promised.

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FPC Orders Name Two Utilities

The Federal Power Commission has ordered the Washington Water Power Co., Spokane, and the Duke Power Co., Charlotte, N. C., to show cause why they should not obtain FPC authorization and license, respectively, for hydroelectric operation.

Washington Water Power was ordered to show cause within 45 days why it should not apply for and secure FPC authorization for the operation of its Post Falls hydro station on the Spokane River in Idaho. The order states that the operation affects the water level of Coeur d'Alene Lake and that it floods and occupies certain federal property. The project has an installed capacity of 11,250 kw.

Duke Power's order directs the company to show cause by September 1, why it should not obtain a license for the operation and maintenance of its hydro project on the Seneca River at Portman Shoals, Anderson County, South Carolina. The order points out that the project is on a navigable stream and that the company has failed to heed a commission notice of April, 1942, that an FPC license for the project is necessary. The project has an installed capacity of 5,590 kw.

UTILITY PLAYERS—Boston Edison's "Little Theater" group of employees contributes relaxation at various army and navy stations in New England as a volunteer war service under the auspices of the USO. "Jack" Caddigan, widely known Edison man and dramatic entrepreneur, is a member of the citizens committee of the USO

P.G.E. Conversion Dam Progressing Rapidly

Approximately $350,000 is being spent by the Portland General Electric Co. on its new conversion dam at Oregon City Falls, the largest single construction project to be undertaken by the company in recent years. Part of the old dam was carried away by high water on January 2 this year. The break was 160 ft. long and to within 5 ft. of the foundation. So it was decided to rebuild completely.

The Gilpin Construction Co. has built a cofferdam to allow the forebay to be drained, and concrete is now being poured on the new dam, which will follow a somewhat shorter course than the old one, which was approximately 875 ft. long. The new dam will contain 12,000 cu.yd. of concrete and will be 25 ft. high. It will have a bridge along the top connecting the various mill buildings of the Hawley Pulp & Paper Co.

When the contractors drained out the water behind the cofferdam on the east side of the river skeletons of river boats, sunken logs and old machinery were found lining the river bottom. Clearly discernible was the mill race of Dr. John McLoughlin, the pioneer factor of the Hudson Bay Company, who was known as the "Great White-Headed Eagle" to the Indians of the early Northwest.

The original parts of the flood-battered dam consisted of wooden deck construction built in 1907. Parts of this were washed away in 1923. The dam was then reinforced with rock-filled timber cribs on the downstream side. In 1935 the top was again raised and additional cribs added on the downstream side. In January of this year heavy debris carried by the current first carried out a small portion of the superstructure, which opening in a few hours was enlarged to the proportions mentioned above.

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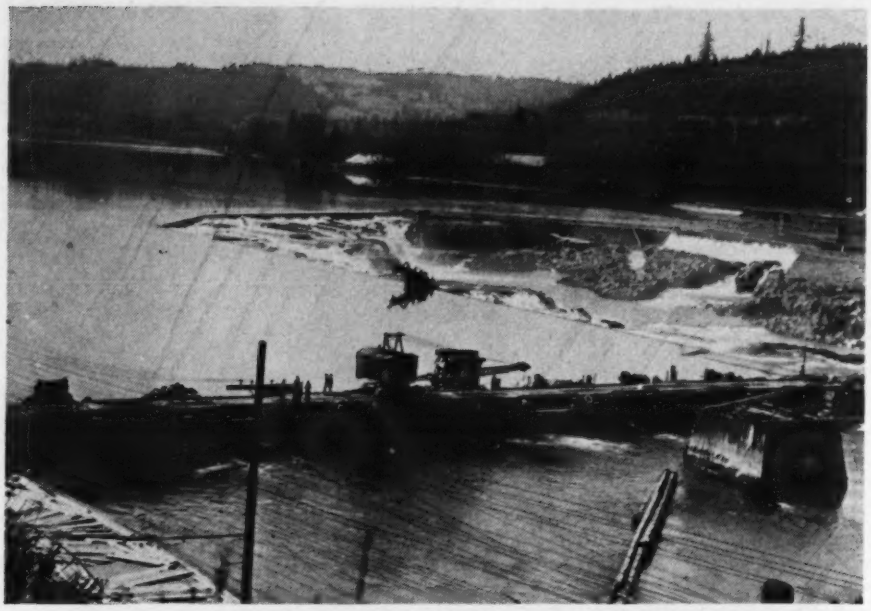
Niagara Falls to Fight Water Rental

The Niagara Hudson Power Corp. has started proceedings in New York State Supreme Court to invalidate legislation, effective last week, permitting the state to collect rental for 15,100 cubic-feet of water per second diverted from the Niagara River by the Niagara Falls Power Co., a subsidiary (ELECTRICAL WORLD, March 6, page 64).

The development followed shortly after the State Water Power and Control Commission had fixed August 2 for a hearing to determine an equitable rental rate for the water the company is diverting. The company said it would ask the court for an injunction, pending the suit, enjoining the commission from fixing the rental. The utility at present pays $400,000 a year for 4,900 cubic-feet of water per second diverted from Niagara.



WOOD CRIB COFFERDAM built to drain the forebay preparatory to building the Oregon City Falls dam. When the area in the foreground was unwatered it revealed the whole history of previous dams back to Hudson Bay times

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Columbia Storage Probe Voted

The House irrigation and reclamation committee will begin hearings in its investigation of plans for the development of the Columbia River Basin late this month or early in August, Chairman Compton I. White, Idaho Democrat, told ELECTRICAL WORLD.

The House last week passed White's resolution for such investigation and voted the committee $5,000. Hearings will be conducted in Washington, D. C., and in Idaho and Montana, according to Rep. White.

The investigation, which has the support of Republicans and Democrats alike in the Northwestern delegation, will be aimed at blocking completely the plans of the Bonneville Advisory Board and the Corps of Engineers to raise the levels of Flathead Lake, Montana, and Lake Pend Oreille, Idaho, to provide an additional 3,000,000 acre-feet of water for the Bonneville and Grand Coulee power stations hundreds of miles downstream on the Columbia River.

REA Appropriation Cut by House

The Rural Electrification Administration got only $20,000,000 in new loan fund authorizations for the fiscal year ending next June 30 as the House forced the Senate to accept its version of REA's budget.

The question of whether to give REA $20,000,000 or $30,000,000 (ELECTRICAL WORLD, July 3, 1943, page 9) was one of the points on which the Agriculture Department appropriation bill was stalled as the deadline for expiration of fiscal 1943 appropriations passed last week. Despite the REA agreement, the bill was still before the Senate early this week, where a motion to recede from other amendments and concur with the House was to be voted upon. Total REA appropriation will be $22,258,000. Certain other funds previously appropriated and never spent also will be available.

•

Dr. W. J. Foster Dies

Dr. William J. Foster, who, during most of his engineering life was engaged in electrical design work on alternating-current rotating machines for the General Electric Co., died in Schenectady, N. Y., on July 2. He was 72 years old. Dr. Foster received the Lamme Medal of the American Institute of Electrical Engineers in 1931 "for his contributions to the design of rotating alternating-current machinery."

Warns on Federal Questionnaires

Measures to correct the issuance by federal government agencies of unauthorized questionnaires, the flow of which are imposing an unwarranted burden on business, were reiterated recently by the advisory committee on government questionnaires, with the concurrence of the Bureau of the Budget.

The advisory committee pointed out that, with few exceptions, requests for information, as defined by law, are subject to the review of the Bureau of the Budget and may not be issued by a federal agency unless authorized by the bureau. A mass of questionnaires which have not been so authorized have come to the attention of the committee, according to W. J. Donald, chairman, and business men are advised to exercise more caution about those report forms that are suspect.

If in doubt, the committe said, inquiry may be made of the advisory committee, the Bureau of the Budget, the federal agency issuing the form, or trade associations, chambers of commerce, etc.

"Business and industry are still largely unaware that a mechanism has been established by which government information requests can be kept to a minimum," Mr. Donald said. "Every authorized request for information, however made, must have the Budget Bureau's approval. These approved forms bear a Budget Bureau approval number, and in most cases an expiration date, both appearing in the upper right-hand corner of the form."

The advisory committee on government questionnaires has offices at 1615 H Street, Washington, D. C., and has a staff in constant contact with the Budget Bureau and industry.

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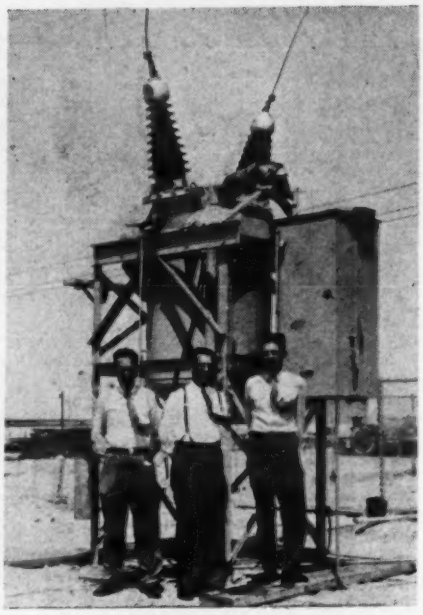
Oil Breaker Takes Double Duty in Test

How older model oil circuit breakers can be modernized to take today's heavier electric loads with the use of a minimum amount of critical materials was demonstrated recently in a unique test at the Nueces Bay power station of Central Power & Light Co.

The facilities of the entire C.P.L. generating system were utilized in the test, when short circuits in excess of 500,000 kva. were applied through the test circuit breaker which had been modified to care for larger short circuits than the circuit breaker had been designed to carry. The particular breaker, shipped to Corpus Christi by the Pacific Electric Mfg. Co., was designed to withstand short circuits of 250,000 kva. maximum.



CIRCUIT BREAKER TEST—M. E. Guyton (center) Pacific Electric Mfg. Co. test engineer, together with Carl Ellis and Paul Taylor of Central Power & Light, tested this oil circuit breaker, which, though designed for 250,000 kva., withstood over 500,000 after some modification in design

In the test, conducted by A. C. Schwager and M. E. Guyton, chief engineer and testing engineer, respectively, of Pacific, and C.P.L. engineers, the revamped oil circuit breaker interrupted currents of more than half a million kilovolt-amperes with nothing more untoward happening than the generation of a paper sack full of gas, caused by the passage of the high currents through the cooling oil.

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Lighting, Wiring Guide Issued by WPB

Lighting specifications for construction or conversion projects now being designed should be checked with the "Design Guide for Interior Electric Lighting and Wiring for Wartime Construction" released last week by WPB's Conservation Division.

The guide presents WPB's conservation policy with respect to lighting and wiring. While it is not an official order or directive, designers should consult it to keep their specifications as nearly in line with its standards as possible. Deviations from the policy outlined in the guide may cause delay or possible denial of priority assistance when applications are made to WPB.

Copies of the guide may be had from the Conservation Division, 11th and H Streets, N. W., Washington 1, D. C.

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New House Power Probe Resolution

Rep. John M. Coffee, Washington Democrat, has introduced a re-drafted resolution calling for an investigation of financial and other assistance rendered by federal agencies in the Shipshaw and other developments outside the United States. The investigation is designed also to spell out the relation between such projects and this country's program for supplying power and facilities for metals production.

The resolution was re-drafted at the request of the House Rules Committee. (Electrical World, July 3, 1943, p. 6) and may, in its new form, place less emphasis on WPB's power program and more on war construction and development programs outside the United States than Coffee originally intended.

Chairman Jesse Jones, of the Reconstruction Finance Corporation, told the Rules Committee that he would welcome such investigation since it would "disprove 99.9 per cent of the charges and innuendos" about RFC's $68,500,000 advance to Aluminum Company of Canada, Ltd. for the Shipshaw project.

MEETINGS

International Association of Electrical Leagues—Annual conference, Netherland Plaza Hotel, Cincinnati, Ohio, September 16-17. O. C. Small, secretary, 155 East 44th Street, New York, N. Y.

Previously Listed

International Association of Electrical Inspectors—Northwestern section, New Washington Hotel, Seattle, Wash., August 26-27; F. D. Weber, secretary, P. O. Box 70, Portland, Ore. Southwestern section, Los Angeles, Calif., week of August 30; H. L. Gerber, secretary, Room 205, City Hall, San Francisco, Calif. Western section, LaSalle Hotel, Chicago, Ill., September 13-15; F. H. Moore, secretary, 320 N. Meridian St., Indianapolis, Ind. Eastern section, New York, N. Y., week of September 20; F. N. M. Squires, secretary, 85 John St., New York, N. Y. Southern section, Roosevelt Hotel, New Orleans, La., September 27-29; C. M. Jones, secretary, 307 Trust Co. of Georgia Bldg., Atlanta, Ga.

American Institute of Electrical Engineers—National technical meeting, Salt Lake City, Utah, September 2-4. H. H. Henline, national secretary, 33 W. 39th St., New York, N. Y.

Municipal Electric Utilities Association of New York State—Annual conference, Lake Placid Club, Lake Placid, N. Y., September 15-17. T. J. McKee, secretary, 200-212 East Third St., Jamestown, N. Y.

Pennsylvania Electric Association—Annual meeting and business conference, Wm. Penn Hotel, Pittsburgh, Pa., September 23. A. B. Millar, managing director, State Street Bldg., Harrisburg, Pa.

Association of Iron and Steel Engineers—Annual meeting, Wm. Penn Hotel, Pittsburgh, Pa., September 28-30. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

Output Curve Off Slightly

The output curve slackened off slightly during the week ended July 3, according to the Edison Electric Institute, arresting a continued more than seasonal rise which began in the first June week. The amount of electrical energy distributed by the light and power industry for the latest week totaled 4,110,793,000 kw.-hr., as compared to 4,120,038,000 kw.-hr. the week previous and 4,098,401,000 kw.-hr. during the week ended June 19. Figures for the latest week represent an increase of 20.1 percent over the corresponding week in 1942.

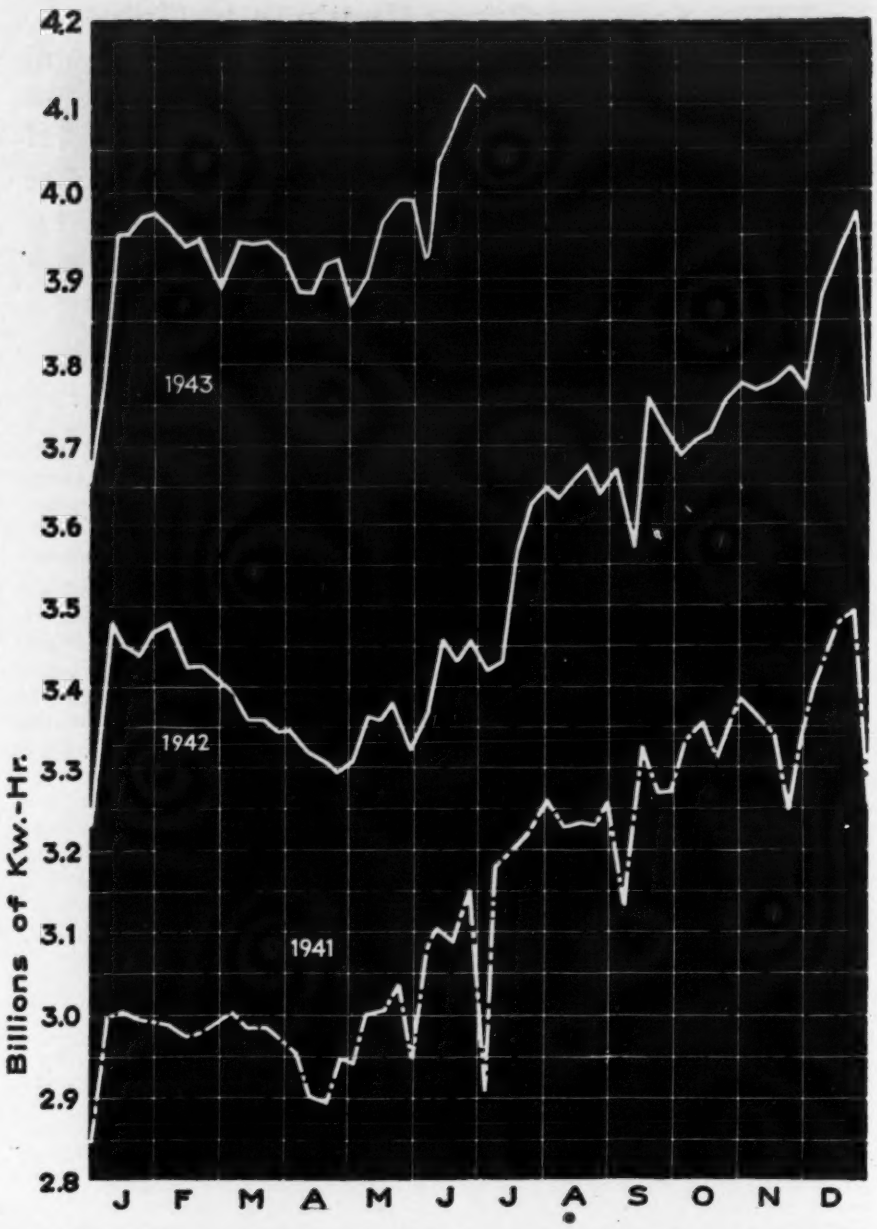
All the major geographic sections of the country showed increases in percentage gains with the exception of the West Central region. The Southern states, for the first time, displaced the Pacific Coast in percentage gain over the 1942 figures with 28.3 percent to Pacific's 26.6 percent.

Weekly Output, Million Kw.-Hr.

1943		1942		1941	
July 3	4,110	July 4	3,424	.....	.....
June 26	4,120	June 27	3,457	June 28	3,157
June 19	4,098	June 20	3,434	June 21	3,091
June 12	4,040	June 13	3,463	June 14	3,101
June 5	3,926	June 6	3,372	June 7	3,076
May 29	3,990	May 30	3,322	May 31	2,955
May 22	3,992	May 23	3,380	May 24	3,040
May 15	3,969	May 16	3,357	May 17	3,011
May 8	3,904	May 9	3,365	May 10	3,001
May 1	3,867	May 2	3,304	May 3	2,945

Percent Change from Previous Year

	Week Ending		
	July 3	June 26	June 19
New England	+13.0	+ 9.3	+ 8.4
Mid-Atlantic	+20.8	+19.2	+17.7
Central Industrial	+19.5	+16.4	+16.1
West Central	+16.3	+17.2	+14.9
Southern States	+28.3	+23.5	+25.9
Rocky Mountain	+16.6	+13.6	+12.5
Pacific Coast	+26.6	+25.0	+27.4
Total United States	+20.1	+19.2	+19.4



Farm Wiring Order Extended

Order P-144, which provides the mechanism by which farmers can get farmstead wiring, has been extend for "a very few days" beyond its June 30 expiration date to give the Agriculture Department time to establish a system for the assignment of allotment numbers to farmers.

The new system was made necessary for the inauguration of the Controlled Materials Plan July 1 as the only means of obtaining copper, steel and aluminum. Under the system, farmers will buy from dealers, who will extend the allotment number to replenish their wire stocks. An Agriculture Department spokesman indicated that supplies of farmstead wiring would total a "very large percentage" of the department's allotment of copper wire.

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Electric Power Needs Up

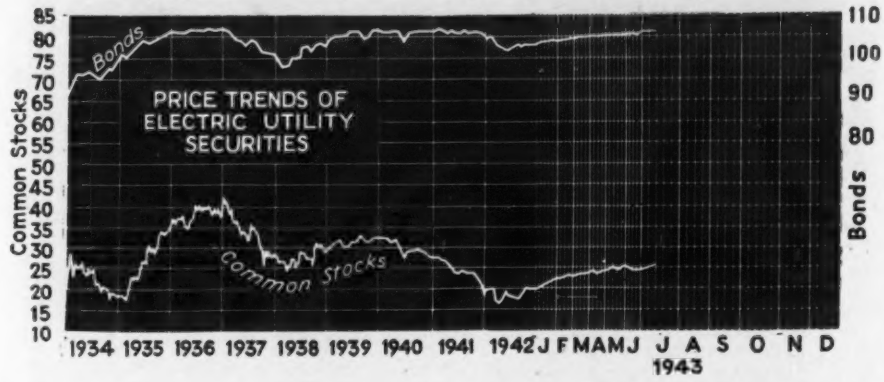
Electric energy requirements of the principal public utility systems of the country during April totaled 16,856,731,000 kw-hr., a gain of 18.9 percent over the corresponding month last year, the Federal Power Commission has announced. Corresponding peak demands aggregated 32,483,831 kw., up 15.6 percent over April a year ago. Utility estimates of peak demands for December, 1943, are reported to amount to 37,858,242 kw., an increase of about 17,000 kw. from a similar forecast submitted by the utilities in their March report.

Boiler Plate Gauge Set to A.S.M.E. Code

Allowable gauge of boiler plate has been tied to the specifications of the American Society of Mechanical Engineers' Boiler Construction Code under Order L-299, which effects steel conservation in boiler manufacture.

Exemptions to the order are boilers for locomotive or marine service and those designed for 15 pounds pressure psi. or less. All other power boilers are covered by the order. Plates used in their construction may not exceed in thickness of quantity of steel the minimum thickness requirements contained in the ASME code. Restrictions do not apply to boilers in process July 1 or those into which a tube is rolled.

Utility Security Prices Continue to Gain


PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Bonds
Common Stocks
Common Stocks
Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1934 1935 1936 1937 1938 1939 1940 1941 1942 J F M A M J J A S O N D
1943

Contrary to the general market trend of the past week, electric light and power stocks made considerable gains. "Electrical World" index advanced to 26.1 from 25.5; last year, 18.4. Bonds gained 0.2 point, reaching 106.3; last year, 103.0

Courts Hand Down Two Hetch Hetchy Decisions

Federal Judge Michael J. Roche in San Francisco has extended for another year suspension of the Hetch Hetchy injunction and thereby guaranteed for at least another twelve months the city's $2,000,000 a month income from its power project. In Washington the U. S. Supreme Court recently refused to review a decision in a water right suit against the city. Judge Roche extended the effective date of the injunction, which prevents the city from selling any of the Hetch Hetchy power to the Pacific Gas & Electric Co., at the request of City Attorney John J. O'Tolle and U. S. District Attorney Frank J. Hennessy. They held that the city eventually will sell all its Hetch Hetchy power to the newly constructed aluminum reduction plant of the Aluminum Corp. of America at Riverbank. The plant now is purchasing some Hetch Hetchy power. The final reduction units are expected to be completed by October 15.

The suit over riparian rights on the Tuolumne River was filed originally in state courts by a group of landowners, who sought to restrain the city from diverting the water of the river in connection with the Hetch Hetchy power project.

•

Halts City Purchase of Utility System

Proposal of the city of Valdosta to issue $1,000,000 in revenue certificates to purchase from the Georgia Power & Light Co. the electric distribution system of Valdosta and adjacent territory was halted by a temporary injunction granted recently by Judge W. E. Thomas of Superior Court.

Charles W. Singleton, who operates ice manufacturing plants in the territory served by Georgia Power & Light Co., filed the injunction, and city officials were served with an order from Judge Thomas to stay all proceedings.

Judge Thomas set the petition for a hearing on the first Saturday following the expiration of thirty days after the filing of answers by the defendants.

•

Uphold SEC Order on International Hydro

A securities and Exchange Commission order of July 21, 1942, directing dissolution of the International Hydro-Electric System, was upheld by the Sixth U. S. Circuit Court of Appeals in Cincinnati recently. Action came on a dismissal of a petition for review of the order, filed by Paul H. Todd of Kalamazoo, Mich., a stockholder.

Utility Reports

	Net Income 1943	1942
*Arkansas Power & Light..	$1,276,538	$2,014,951
*Central Maine Power.....	3,429,453	3,235,738
*Cons. Gas Electric Light & Power (Balto.) and sub.	6,078,432	6,546,922
*Dallas Power & Light.....	1,496,547	1,627,639
*Florida Power & Light....	2,121,594	1,331,079
*Idaho Power	1,428,745	1,132,874
*Kansas Gas & Electric.....	1,514,171	1,263,846
*Louisiana Power & Light..	1,360,698	1,042,888
*Marion-Reserve Power	401,824	464,281
*Mississippi Power & Light.	790,346	533,718
*Montana Power and subs.	3,748,284	3,104,258
*Nebraska Power	1,811,933	1,317,738
*New Orleans Public Service	2,294,178	2,138,699
*Northwestern Electric	697,295	561,109
*Texas Electric Service.....	1,976,302	1,017,986
*Texas Power & Light.....	2,414,487	1,430,974

*Twelve months ended May 31.

FINANCIAL BRIEFS

COMMONWEALTH & SOUTHERN CORP.'s proposal to pay from capital a dividend of $3 a share, or a total of $4,446,000, on its preferred stock, has been approved by the Securities and Exchange Commission. The dividend payment is to be in lieu of a cash payment of $3 a share on the preferred stock, which was one of the provisions of the one-stock recapitalization plan filed by the company and pending before the commission.

THE SEC HAS PROHIBITED North American Light & Power Co. from paying to the North American Co., the parent concern, the interest due on debentures of the former held by the latter. The commission ordered Light & Power to segregate from its other funds a sum equal to the amount to be withheld—about $154,000 semi-annually—and authorized the company to invest the funds in obligations of the U. S. government.

A $3,000,000 BOND ISSUE of Tacoma City Light, for the second Nisqually power development, has been sold to Shields & Co. and associates, highest bidder.

NATIONAL POWER & LIGHT CO. made a book profit of $7,723,536 on the recent sale of the balance of its holdings in common stock of Houston Lighting & Power Co., according to a report filed with the SEC. National sold 242,664 shares of the stock to a syndicate at $51.85 a share and received cash in the amount of $12,582,128. National had carried these shares in its investment account at $4,858,591. The profit was credited to earned surplus less $54,539 expense in connection with the sale.

A PROPOSAL of Milwaukee Electric Railway & Transport Co. to purchase for cash at par from Wisconsin Electric Power Co. 8,000 shares of its own common capital stock, par value $100 a share, for retirement, has been approved by the SEC.

COMMUNITY PUBLIC SERVICE CO. has filed a registration statement with the SEC for $6,850,000 of first mortgage bonds, 3⅜ percent series, due 1973. Proceeds from the sale will be used to refund its $6,854,000 of 4 percent first mortgage bonds.

IN CONNECTION with a proposed $44,000,000 refunding program, Utah Power & Light Co. has registered with the SEC $37,000,000 face amount of first mortgage bonds, series due 1973.

The Transformer THAT MADE THE Load-center Unit Substation Possible

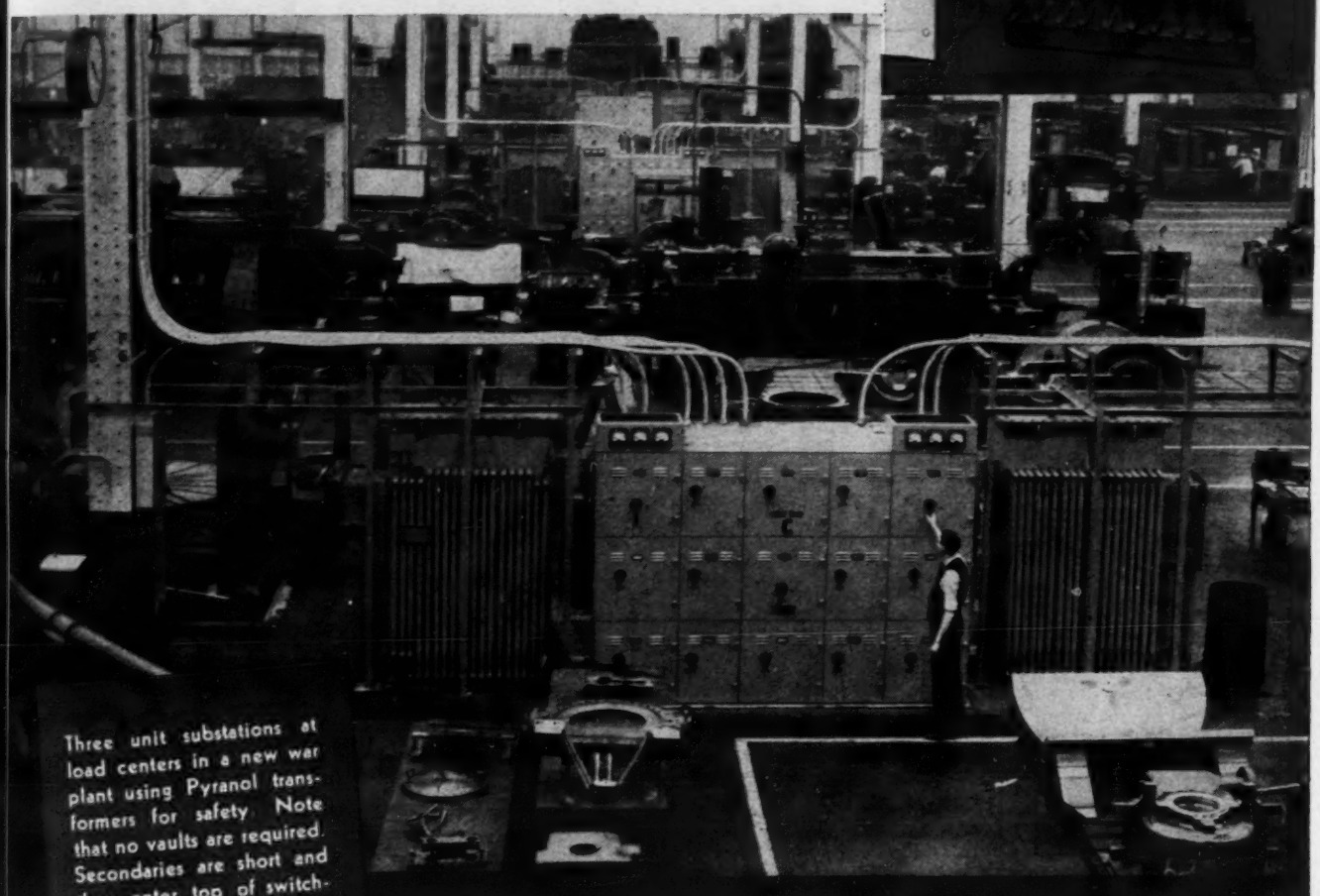
THE inherent safety of Pyranol* transformers led to the development of the modern load-center system of power distribution. It made possible the basic element of such a system, the load-center unit substation.

In turn, these easy-to-order, easy-to-install unit substations enable war plants to get rolling months sooner than would be possible otherwise. And because Pyranol transformers permit installation in or near the working areas, the elimination of long secondaries is saving thousands of tons of copper. Power losses are reduced, and voltage regulation is improved.

Remember, too, that Pyranol transformers are ***all-purpose*** units. Whether or not unit substations are called for, Pyranol permits installation anywhere you wish, indoors or outdoors, above ground or underground, in places wet or dry, clean or dusty. Whatever location you choose, these transformers will simplify your installation problem, and will supply the power for your war loads with little or no maintenance. Write for Bulletin **GES-2974**. ***General Electric, Schenectady, N. Y.***

*Reg. U.S. Pat. Off.

- - - the All-purpose
PYRANOL TRANSFORMER
for Safety and Savings

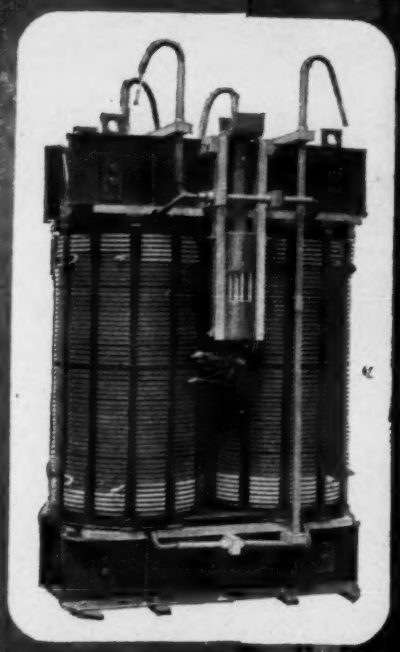


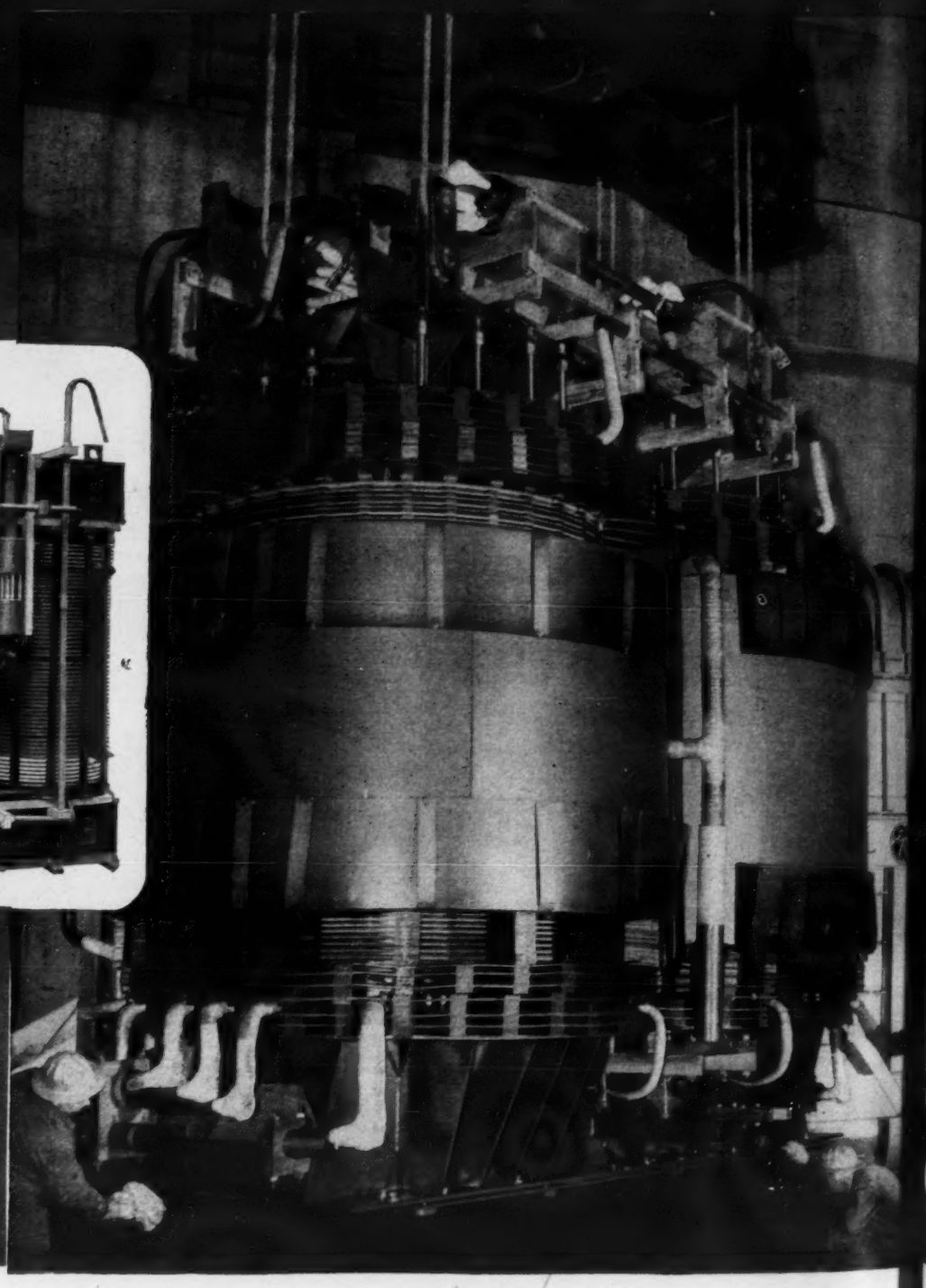
Three unit substations at load centers in a new war plant using Pyranol transformers for safety. Note that no vaults are required. Secondaries are short and they enter top of switchgear to save tons of copper.

GENERAL ELECTRIC

SHIELDED WINDINGS

TWO TYPES OF SHIELDING: (Right) Single-phase, 36,000-kva, 230,000-volt transformer with shields surrounding high-voltage windings. (Below) Single-phase, 26,600/-46,000Y-volt transformer with shields at top and bottom of each high-voltage coil stack.





GE

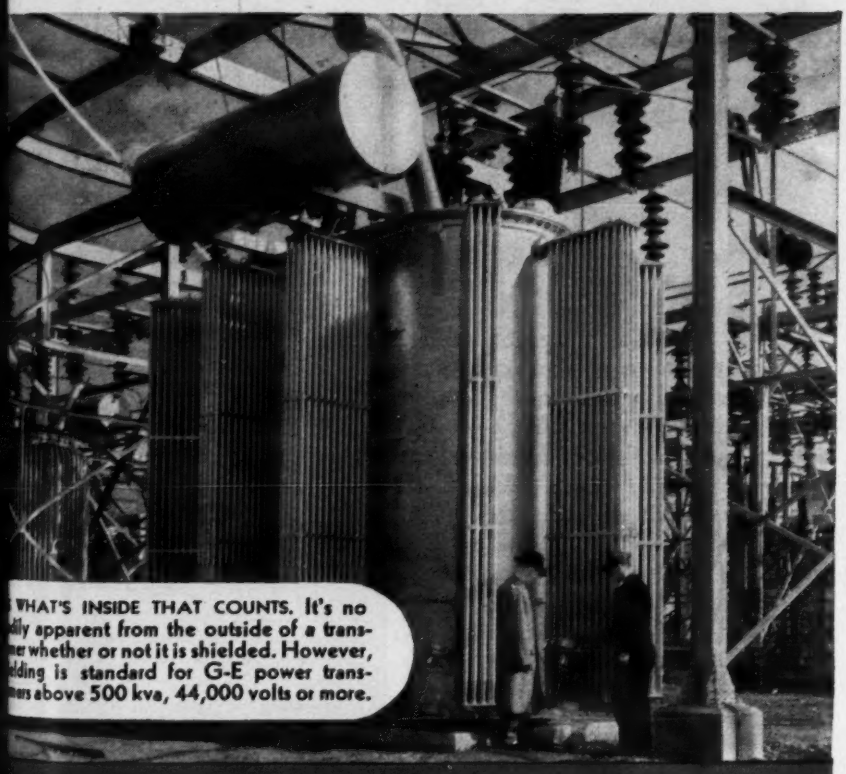
POWER TRANSFORMERS

for Real Protection of 3-SHIFT POWER for War Production

2500 IN SERVICE Wherever G-E shielded-winding transformers are supplying power—for the production of vital war goods or for the home—they are helping to ensure service continuity.

The G-E shielded winding has proved to be the most nearly perfect means yet devised for preventing concentrations of voltage stress within power transformers, which might be caused by switching surges or lightning impulses. Shielding enables the transformer designer to know definitely the maximum stress for which he must insulate at each point throughout the winding.

More than 2500 G-E shielded transformers, totaling more than 21,000,000 kva, installed over a period of 16 years, are now serving the war effort. *General Electric Company, Schenectady, N. Y.*



WHAT'S INSIDE THAT COUNTS. It's not fully apparent from the outside of a transformer whether or not it is shielded. However, shielding is standard for G-E power transformers above 500 kva, 44,000 volts or more.

GENERAL ELECTRIC

401-14-5155

What Is a Shielded Transformer?

A transformer is called "shielded" when its winding is equipped with properly insulated metallic surfaces, *connected to the line terminal,* and so proportioned as to effect a radical reduction in the lightning stresses inside the winding.

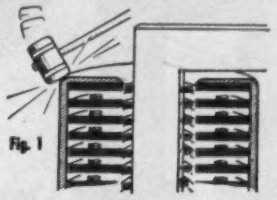


Fig. 1

Why Does Shielding Reduce Lightning Stresses?

Fig. 1 illustrates the effect of a sudden blow on a brittle mechanical structure protected by a steel shield that envelops the corner of the structure. The shield distributes the force of the blow over a sufficient area to *prevent concentration* of stress at any point, enabling the structure to stand, without damage, a blow that would otherwise be destructive. In a similar way, the shield shown in Fig. 2 envelops the corner of the transformer winding and *prevents concentration* of lightning voltage.*

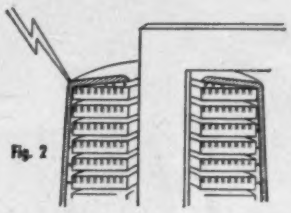


Fig. 2

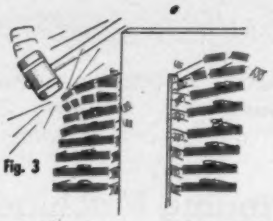


Fig. 3

In Fig. 3, the same mechanical structure, but without shield, is destroyed by a blow of the same severity, because of *concentration* of mechanical stress at the point of impact. This compares with the unshielded transformer winding subjected to lightning impulse, as shown in Fig. 4.

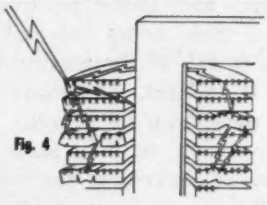
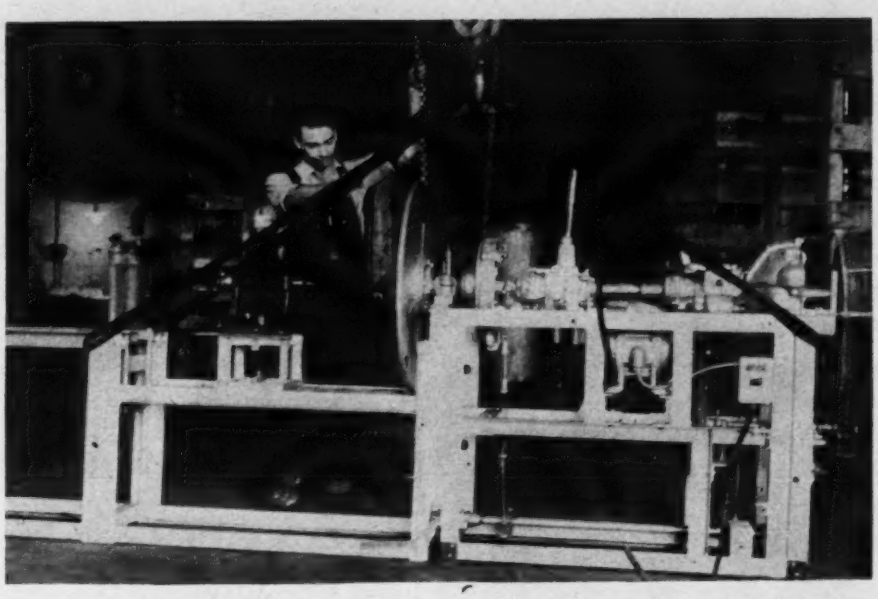


Fig. 4

The G-E shielding principle is as simple as it is effective. External application of the shields permits the retention of all the desirable features of G-E circular-coil construction. For a complete description ask for Bulletin GEA-2305.

**Voltage concentration* at the end *of the winding also causes internal oscillations which produce high-voltage concentrations within the winding, comparable in severity with the initial impact. These oscillations, too, are prevented by shielding.*

HOW DESIGN... CONSTRUCT OPERATE MAINTAIN



WINDING MACHINE with variable speed secured by automobile transmissions in tandem

Winding Machine Has "Transmission" Drive

In the shop of the Montana Power Company, Butte, Mont., where I. D. Hadzor is shop superintendent, many of the pieces of equipment are home designed and home built, not the least of these being the coil winder shown in the accompanying illustration. It is light, yet sturdy enough to be picked up by a crane and set for operation at any place in the shop most convenient for the job in hand.

Frame is of welded construction, made of angle iron and in three "panels"; the two panels at the left may be removed when large work is to be mounted on the disk.

The machine is operated by a 2-hp. a.c. motor located in the panel at the right. The motor drives a jack shaft and the main shaft by two V-belts. Each belt and set of sheaves is a reduction, which brings the speed of the motor down to approximately that desired for operation of the lathe-like machine.

The power is then transmitted to the chuck or face plate, whichever is being used, through two Chevrolet transmission assemblies connected in tandem. Each, of course, has three speeds forward, as well as one in reverse. In this way nine forward speed changes can be secured by manipulation of the gear shift levers on the two transmissions.

In operation, the clutch is used on the shaft to the first transmission. There is also a brake at the other end next to the disk, both clutch and brake being manipulated by a foot pedal, which, when pressed down, disengages the clutch and applies the brake, and when released puts the machine in operation.

•

Water Lance Sinks Ground Rods 25 Ft.

By using a modified "water lance" to sink short (8-ft.) ground rods to depths of 25 ft., instead of driving 15- or 20-ft. rods flush with the ground, the Union Electric Company is securing equal or better ground resistance. The method has enabled the company to carry on a common neutral grounding program in Alton and East St. Louis, Ill., during wartime with the expenditure of very little critical material.

Economy of material, through the use of shorter rods, has been enhanced by salvaging existing 15-ft rods and cutting them into two sho

LANCE driven by electric drill and supplied with water at 50 lb. pressure from trailer tank sinks 20-ft. hole for ground

WHEN you use G-E fuse cutouts, smaller stocks adequately take care of your requirements. Why? Because each G-E cutout can do any one of three different jobs. You can convert a G-E cutout from a single-element unit to a reclosing unit, or to a disconnect, simply by changing the door.

The single-element door has a selecting device to permit either indication of a blown fuse or "drop-open" action. The reclosing door contains the entire mechanism, complete with one-second time delay before reclosing. The disconnect door has an indicating feature for easy spotting, and a can't-be-lost blade which is isolated to protect the lineman.

Just five major parts, in the 50-ampere rating, will fill 80 per cent of all distribution-cutout requirements. And there's a similar two-housing, three-door combination in the 100-ampere rating to take care of the other 20 per cent.

Ask for Bulletin GEA-3448. *General Electric, Schenectady, N. Y.*

FUSE CUTOUTS

GENERAL ELECTRIC

rods, with the result that very little new material has been drawn from stock. Ground clamps have been eliminated by soldering or brazing scrap copper leads to the rods in the shop. The return to stock of primary neutral wire and neutral lightning arresters has been a by-product of the grounding program.

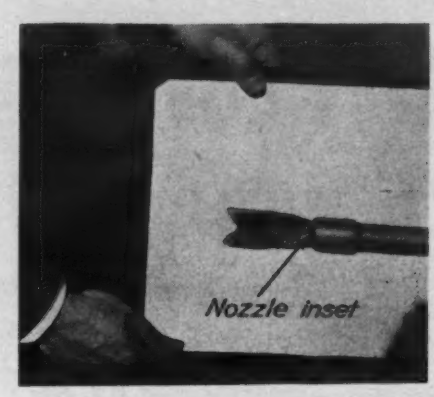
This method of "countersinking" short ground rods is fast; from 18 to 20 grounds can be completed in a day by an "average" line crew. It results in ground resistances of the order of 5 to 10 ohms in gumbo soil, and in general it returns to stock

SHORT 8-ft. ground rod is hand tamped into bottom of 20-ft. hole drilled by water lance

more critical material than is required for the work.

The water lance used in the operation was assembled from standard non-critical hardware parts readily available. It is essentially two 10-ft. sections of $\frac{3}{4}$-in. extra-heavy pipe with a fishtail drill point on one end and a water jacket for introducing water at about 50 psi. at the other. The water passes through the lance and is ejected through two $\frac{1}{8}$-in. nozzles inset on either side of the drill point. Upper end of the lance has a square shank which fits the chuck of an electric drill that turns the lance as it drills into the soil. The water jets flush soil away from the drill point as it passes downward.

Water for the drilling operation is pumped under pressure from a 375 gal. trailer-mounted tank drawn by the line truck. About 25 gal. of water is used for each hole. The tank is filled twice a day, once at



CLOSE-UP of fishtail drill point; note ⅛-in. diameter nozzle

the garage and once during the day.

Drilling is started with a 10-ft. lance, for convenience, and the second section coupled to it. When the 20-ft. hole is down the lance is removed and the 8-ft. rod with lead attached is dropped to the bottom and driven in by hand, using a pipe tamp that fits over the upper 18 in. of the rod.

Ground resistance is checked on the spot by connecting a 6-amp., instantaneous-trip, magnetic breaker between the rod and the 120-volt leg of the secondary circuit. If it trips the ground is satisfactory. If not, it is measured subsequently with instruments and additional rods driven if needed.

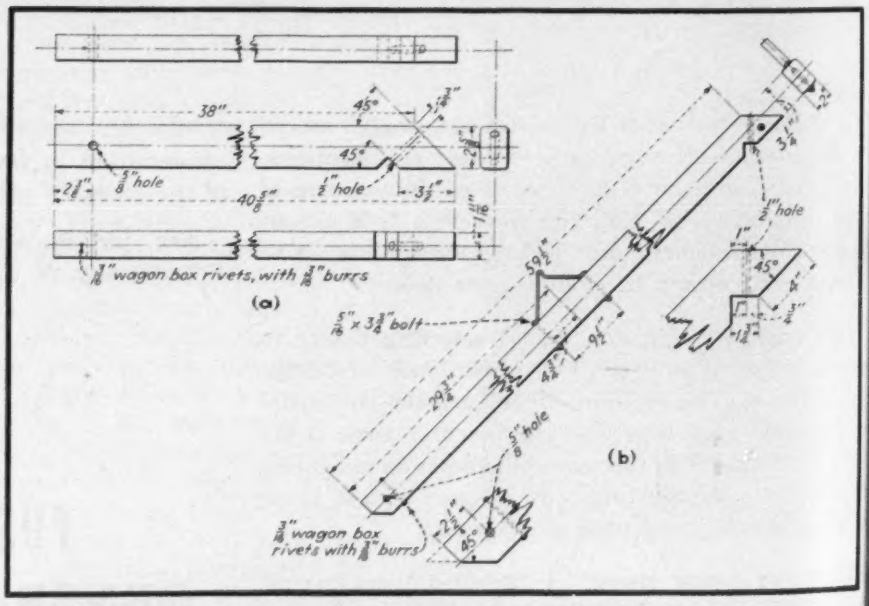
In cases where there is no water system ground on a customer's premises practice is to install a separate ground at the transformer pole for the primary lightning arrester and connecting it with the common neutral ground through a gap-type arrester. Grounds are installed on poles on either side of transformer installations, as well as on the transformer pole itself. Maximum distance between grounds on the system is 1,200 ft.

Before this method of driving ground rods was adopted it was not possible to secure priorities for continuation of the common neutral grounding program, due to the number of 15-ft. ground rods and clamps required to give desired ground resistance in gumbo soil. This method was directly responsible for reducing the amount of new critical materials required for the program, to the point where the necessary priorities would be obtained.

•

Make Alley Braces From Fir Crossarms

Shown are details of wood alley-arm braces made from 10-ft. fir crossarms and used on the system of the Wisconsin Electric Power Company as a wartime substitute for nominal 30- and 60-in. steel braces. Crossarms that are unfit for reinstallation where the outer wood is checked or splintered but the inner wood is sound and in good condition are used for this purpose. These crossarms are without pinholes since the company uses clamp-type pins as standard construction. Only holes in the arms from which the braces are made are the through-bolt hole and smaller holes for fastening crossarm



WOOD SUBSTITUTES for (a) 30-in. and (b) 60-in. steel alley-arm braces

Wonder what an empty socket thinks about?

Peacetime surveys have repeatedly shown that an average of 10% of the nation's residential sockets were empty. Whatever the percentage of empty sockets may be in your territory normally, the situation has undoubtedly been aggravated by the war . . . and the percentage of empty sockets probably will increase as the war goes on.

WHEN THE WAR IS OVER

One fact is clear. When the war is over, there will be a lot of empty sockets waiting to be filled. And the lighting industry's Number One activity at that time will consist of filling those empty sockets.

The moment priorities are lifted, lighting is one thing you can sell immediately. Plant re-tooling won't hold up lamp bulb production. The major change-over from wartime to peacetime production in the lamp business will be a change in shipping labels.

BETTER LIGHTING FOR A BETTER WORLD

Naturally out of the war will come new lamps, new kinds of lighting, new fixtures made of new materials not only for homes but for stores, schools, offices, theatres, streets . . . in fact for every place where better lighting can help make a better world.

In the meantime the lighting industry's major job is to continue to help war plants get better production with present equipment . . . and to show residential and commercial customers how to make the best use of the lighting equipment they have.

G-E MAZDA LAMPS

GENERAL ELECTRIC

Listen to the G-E MAZDA *Lamp "Hour of Charm" Sundays 10 P.M. EWT, NBC; and to "The World Today" Weekdays, 6:45 P.M. EWT, CBS.*

★ THE BEST INVESTMENT IN THE WORLD IS IN THIS COUNTRY'S FUTURE — BUY WAR BONDS ★

braces. Braces are given a five-minute bath in hot creosote as a preservative treatment.

•

Experience With Portable Substations*

By R. McC. BYERS
Assistant to the Electrical Engineer, Consolidated Gas, Electric Light & Power Company of Baltimore

Six years of experience with portable substations on the radial distribution system of the Consolidated Gas, Electric Light & Power Company of Baltimore includes a trailer-mounted portable transformer for connecting into a circuit in an emergency.

In 1937 load forecasts indicated the necessity of purchasing several large transformers to maintain the required safety margin at certain substations. By providing only one 6,000-kva. portable spare transformer the company could raise the safe load limit for each of seven large substations to a value corresponding to the one-time emergency peak rating of the transformers representing the firm capacity of the respective substations instead of the lower recurrent overload capacity. In this way a 6,000-kva. unit costing only $2.80 per kva. could provide additional substation transformer and switching capacity valued at nearly eight times its own investment.

The unit consisted of a transformer permanently mounted on a semi-trailer and provided with portable cables to facilitate connections to the switching circuit of the transformer to be replaced. The semi-trailer was a standard low-bed machinery-type model designed for maneuverability and to fit the company's fleet of pneumatic-tired utility tractors. For unrestricted movement on the streets and roads without the necessity of permits, the 33-ton gross weight of this combination is within the legal weight limits, as are the tire and axle loadings.

The 13,200/4,400-volt, three-phase auto-transformer is the OISC type with nitrogen cushion and provision for future forced-air cooling. For safety during curb-side parking, there are no exposed live parts, since the bushings are inclosed in metal housings and the high-tension and low-tension portable cables have grounded copper sheaths protected by over-all jackets of tough selenium and tellurium-cured rubber.

This large unit is not a complete portable substation with switching equipment, since such an apparatus was not required on the urban system. The unit has been called out on four occasions and has been in active service for emergency and maintenance purposes for one-third of the time since its construction in 1938.

PORTABLE "substation" is a 6,000-kva., 13/4-kv., three-phase transformer mounted on a semi-trailer

* First installment of four articles.

Comparative Tests of Rope Hand Lines

By HOWARD MILLER
Safety Supervisor, Southern California Edison Company, Los Angeles

Substitution of new materials and tools has created an additional accident hazard for operating personnel. Because workmen learn by experience the stresses which can safely be put on tools and materials, it is essential that they be given reliable information about any substitutes, and particularly those involving inferior materials.

One important substitution brought on by the war is the use of sisal for manila rope. In appearance sisal is as good as if not better than manila. When new, the better grades of sisal rope will test about 80 to 85 percent as strong as new manila rope; however, the deterioration period is much shorter. This constitutes a real hazard until some method of determining the extent of deterioration is devised. The results of tests made by the Southern California Edison Company as set forth in the accompanying table are not conclusive, but should indicate the importance of making further tests and getting this information to the men in the field.

Two hand lines were made up—one of ½-in. manila rope and one of ½-in. sisal rope. Tests were made of the new rope and the hand lines were then put in service. Five months later they were called in and tested, with the results shown in the table. Interesting facts brought out by the tests were as follows: The new sisal was 85 percent as strong as the new manila. After five months' use the sisal was 64 percent as strong as the used manila. The average tests indicated the sisal had deteriorated 54 percent; the manila 38 percent. The heavily used end of the sisal had deteriorated 64 percent; the like end of manila 58 percent. The lightly used end of sisal had deteriorated 55 percent; the like end of manila only 30.

Table I—Comparative Tests of Sisal and Manila Rope Hand Lines

	Manila Rope Load at Breaking (Lb.)	Sisal Rope Load at Breaking (Lb.)
New rope	2,975	2,540
After five months use		
Average of five parts of line..	1,846	1,178
Hook or heavily used end	1,260	920
Snap or lightly used end	2,080	1,150

Protect Wiring with

G-E CONDUIT

in Wet or Hazardous Locations

Avoid wiring breakdowns. Use G-E White zinc-coated rigid conduit and G-E Black enamel-coated conduit to protect wiring in hazardous and wet locations. Use them for maintenance work, for wiring conversion and for new war wiring.

WPB Limitation Order L-225 permits the following uses for rigid conduit: (Type of protective coating is not restricted.)

1. In war implements such as warships, aircraft armament, tanks, etc.

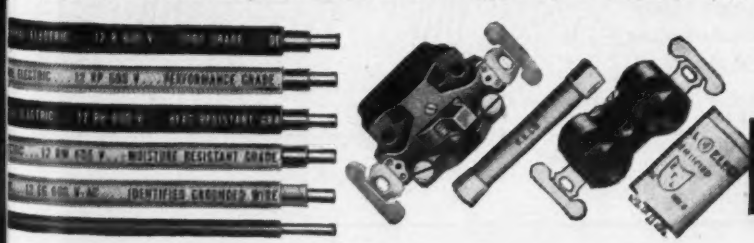
2. In projects rated A-1-J or better for hazardous or wet locations (with conduit size limitations).

G-E White, hot-dipped galvanized inside and out, has a highly protective layer of pure zinc. G-E Black is coated inside and out with a corrosion-resistant asphaltic-base enamel.

ELECTRICAL METALLIC TUBING FOR WAR PURPOSE WIRING

G-E high quality, long service EMT is available to protect war wiring. WPB Limitation Order L-225 permits EMT sizes 3/8" to 2" to be used on projects rated A-1-J or better to enclose wires: exposed to mechanical injury in the wiring to machinery; or in concrete; or in elevator hoistways; or in wet locations.

G-E WIRE AND CABLE AND WIRING DEVICES FOR WAR WIRING
You'll find the wires and cables and wiring devices you need in the G-E line for maintenance jobs and for new wiring. They are high quality.



FOR FURTHER INFORMATION about G-E conduits, wires and cables and wiring devices see the nearest G-E Merchandise Distributor or write to Section CDW-735-9, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

GENERAL ELECTRIC

HOW TO DETERMINE
SETTING FOR FEEDER REGULATORS†

Accompanying line drop compensator setting chart can be used for both single-phase and three-phase regulators. An example is included to illustrate the use of the chart; no calculations are necessary

Example for Use of Chart

(Dotted lines illustrate the procedure)

Length of feeder to load center=15,000 ft.

Size of overhead conductor = No. 2/0

Equivalent conductor spacing = 30 in.

Regulator series-winding current = 200 amp.

Pt or control supply winding ratio = 20:1

Type of circuit = 3-phase wye

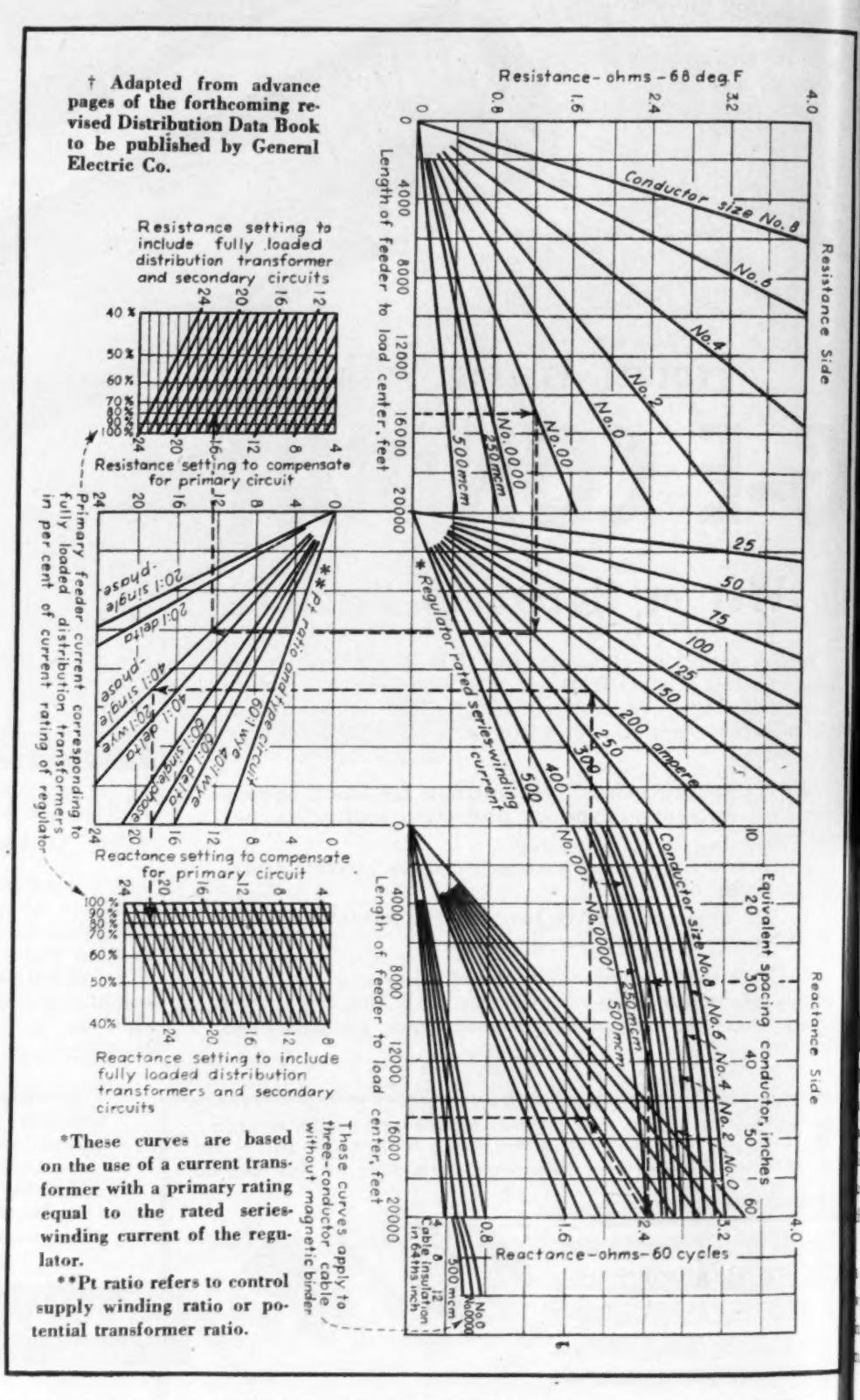
Primary feeder current corresponding to fully loaded distribution transformer in percent of current rating of regulator = 80 percent

Volts compensation for primary circuit = Resistance 12 ohms; reactance 18 ohms

Volts compensation, including fully loaded distribution transformers and average secondary circuits= Resistance 17 ohms; reactance 22 ohms

When using the chart for cable circuits, select the point of intersection of the vertical line corresponding to insulation thickness and the curve corresponding to conductor size. From this point continue left horizontally to the vertical line marked 20,000 feet, then follow parallel to the radial lines down to the left to the proper length of feeder to load center. Then proceed horizontally to the left to the proper radial line representing regulator rated series-winding current. For procedure from this point refer to example above to obtain reactance setting of compensator. For resistance compensation follow same procedure as shown in example for overhead circuits.

† **Adapted from advance pages of the forthcoming revised Distribution Data Book to be published by General Electric Co.**


Resistance setting to include fully loaded distribution transformer and secondary circuits
Resistance setting to compensate for primary circuit
Primary feeder current corresponding to fully loaded distribution transformers in per cent of current rating of regulator
Reactance setting to compensate for primary circuit
Reactance setting to include fully loaded distribution transformers and secondary circuits
Resistance-ohms-68 deg F
Length of feeder to load center, feet
Conductor size No. 8
No. 6
No. 4
No. 2
No. 0
No. 00
No. 000
No. 0000
250 mcm
500 mcm
Resistance Side
* Regulator rated series-winding current
25
50
75
100
125
150
200 amperes
250
300
400
500
Reactance-ohms-60 cycles
Equivalent spacing conductor, inches
Reactance Side
Cable insulation in 64ths inch
8
12
300 mcm
No. 0000
*These curves are based on the use of a current transformer with a primary rating equal to the rated series-winding current of the regulator.
**Pt ratio refers to control supply winding ratio or potential transformer ratio.
These curves apply to three-conductor cable without magnetic binder

An air-minded world waits for wings

BECAUSE of the airplane, the peace to come can be as global as the war. Trade and transportation will move freely to peoples never before a part of the world's markets. Millions to whom modern life is unknown have already met and understood the airplane. Like all of us, they will welcome its cargoes.

Such an opportunity can help maintain a war-size aircraft industry. The largest warplanes, the speediest bombers, may be inadequate for coming needs of passengers, mail, air express and freight.

The air industry can plan for an era of conversion and new production with a freedom in one way unknown. Materials will be available in almost endless quantity and variety. Revere alone will be ready with all forms of copper, as well as with gifted new alloys. But which metal should be used for what? The choice may not be easy.

For impartial answers to questions about metals, industry can turn to Revere. For just as industry in the future will not be restricted to the traditional materials, neither will Revere. Since the start of the war, in addition to widening still further the uses for copper and its alloys, Revere has developed facilities for manufacture of the light metals, and is pioneering in the production of wholly new alloys that can cut manufacturing costs for many industries.

Today the copper industry is producing all-out for war. No copper is available for any other use. But post-war planners with specific problems in metals are referred directly to the Revere Executive Offices in New York.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Ave., New York

Sequence Control of Motors

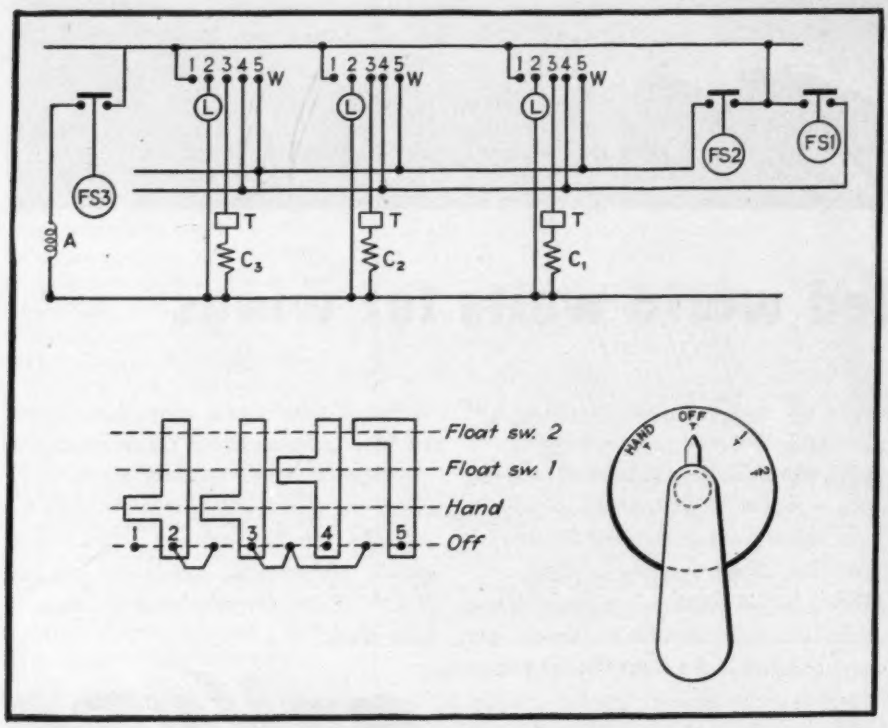
By E. R. BONDS
Robert & Company, Inc., Atlanta, Ga.

When a pair of motors is installed to operate in sequence according to load requirement, as in maintaining liquid level in a tank or reservoir—one motor starting when the level raises or drops to a certain point and the other coming in if level continues to rise or fall—it is usually desirable to alternate the motors in the position of first response. Also, there may be a third motor held as spare for assurance of unimpaired performance and this one should be given a tour of duty once in a while.

It is a practice of Robert & Company in such problems of design to make use of a rotary control switch, such as the Westinghouse type W which is incorporated in the accompanying layout of pump control. In this scheme there are three float switches set for different levels in the tank, the top setting to control the designated first pump, the middle, the second and the bottom to sound a low water alarm.

There are three pumps, two in normal use and the third a spare. By settings of the rotary control switches it is possible to put any of the pumps into first, second or spare positions and thus to distribute duty among them. A particularly useful feature of the scheme illustrated is the red lamp which is lighted when the pump is operating on hand control, telling the operator that the particular pump is not responsive to a float switch.

Although not availed of in the illustrated scheme, the rotary control switch has an interlock possibility that is useful in other kinds of applications. They may be obtained with keyed handles removable only in the "off" position. Thus if it is desired to limit the number of motors in simultaneous operation, handles of only that number are furnished to the operator.



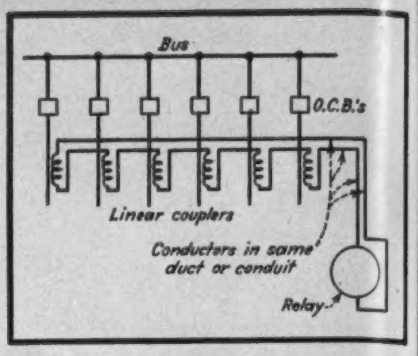
SCHEME of sequence control of pumps including (below) development of rotary switch operation.

Designations are: F. S., single-pole, single-throw float switch; L, red indicating lamp; C, closing coil on motor starter; T, thermal overload device; W, drum type rotary control switch; A, alarm signal

Linear Couplers Used for Bus Protection

By W. K. SONNEMANN,
Relay Engineer, Westinghouse Electric & Manufacturing Company, Newark, N. J.

"Linear Coupler" bus protection is a differential scheme using air core mutual reactors, called Linear Couplers, and relays of suitable sensitivity. Voltages are generated in the Linear Couplers in proportion to the current flowing in their primaries. For normal load and external fault conditions the voltages generated in the relay-coupler loop oppose each other and no relay current flows. For the internal fault condition there is a net voltage in this loop which causes a relay current to flow and actuate the relay.



SCHEMATIC DIAGRAM of Linear Coupler bus protection

This system of bus protection may be utilized in any application where two conditions can be met. First, the maximum external fault current should not exceed the minimum internal fault current for which the system is expected to operate by more than 17 times. Second, the minimum internal fault current must equal or exceed the value given by the equation

$$I_p = \frac{nZ_c + Z_R}{0.005}\sqrt{\frac{B}{Z_R}} \qquad (1)$$

where I_p = primary fault current in amperes, nZ_c = total impedance of all the Linear Coupler secondaries in series, Z_R = relay impedance (phase relays) which is adjustable and B = energy required by the relay to operate, this being expressed in volt-amperes.

The first requirement is concerned with the accuracy with which the Linear Couplers are made, due allowance being made for safety factor. The second requirement is inherent in the scheme and represents an interpretation of Ohm's law in terms of the constants of the circuit.

A complete differential scheme requires that each circuit to a bus must be equipped with a Linear Coupler in each phase. It is therefore obvious that for a smaller number of circuits the impedance of the coupler-relay loop will be less, a smaller voltage will be required to circulate relay tripping current, resulting in the ability to detect smaller fault currents;

Sabotage in the Camouflage Corps

Microorganisms which cause damage to paint camouflaged surfaces are saboteurs of the first order. Regardless of the tenacity of these organisms, however, they can be satisfactorily controlled with Dowicide.

Exhaustive tests in numerous industrial fields have led to the development of 17 Dowicide products—all produced from chlorinated phenols. Textiles, paper and leather products—for example—also benefit from Dowicide applications. Because of their effectiveness in controlling the growth of microorganisms, Dowicides are performing invaluable service for industry. During these times when products are being shipped to the far corners of the earth and subjected to the most gruelling conditions, this extra protection is doubly desirable.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • St. Louis • Chicago • Houston • San Francisco • Los Angeles • Seattle

DOWICIDE'S USE IN POWER TRANSMISSION AND COMMUNICATIONS—Poles and other timbers for outdoor use produce longer service and require less maintenance when impregnated with Dowicide. Oil soluble Dowicide 7 and water soluble Dowicide G are both used for this purpose. Either is simple to use leaving the wood odorless, free of discoloration, completely paintable and efficiently protected from decay and termites.

DOWICIDE

GERMICIDES AND FUNGICIDES

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY

in general, the couplers will run from about 3 to 8 ohms each. Two relay models are available. One is adjustable over a range of from 0.5 to 8 volt-amperes. Range of the other is from 0.0085 to 0.062 volt-amperes. The impedance of the relay, Z_R, is generally matched to that of the couplers, nZ_c, for maximum sensitivity.

For example, assume that a minimum fault current for which tripping is desired is 1,000 amp. for a 12-circuit, 13.2-kv. bus, and that space is available either in the structure or in the oil circuit breaker bushings to install Linear Couplers having a self-impedance of 6 ohms each. The total coupler impedance per phase is $6 \times 12 = 72$ ohms. For a relay having impedance taps of 30, 40, 60 and 80 ohms, select the 80-ohm tap to approximately match the 72-ohm coupler impedance. For a trial, assume that the impedances add arithmetically and substitute in equation (1)

$$1{,}000 = \frac{72 + 80}{0.005}\sqrt{\frac{B}{80}}$$

from which $B = 0.0862$ volt-amperes. This is greater than the maximum setting of the more sensitive relay and less than the minimum setting of the less sensitive relay. The required setting can be obtained however, by using the more sensitive relay and by connecting a resistor in the circuit to absorb the excess energy. On the other hand, it may be desired to utilize the sensitivity available in the relay and set for a lower tripping current, which can be done down to 1/17 of the maximum fault current.

On some systems the single-phase-to-ground fault current is severely limited by a grounding impedance, making necessary the use of a fourth relay for ground-fault protection which is set for much less than 1/17th of the maximum phase-fault current. It is desirable in this case to supervise the fourth relay by means of a single-phase-to-ground fault detecting relay. The fourth Linear Coupler relay may be connected in the residual circuit of the Linear Couplers and phase relays and the formula for its operation is

$$I_s = \frac{nZ_c + Z_R + 3Z_g}{0.005}\sqrt{\frac{B}{Z_g}} \qquad (2)$$

where I_g = primary ground-fault current for which the relay is set to trip, Z_g = impedance of the ground relay, and other quantities are as in equation (1).

When a fourth relay is used for sensitive ground fault protection, supervised by a single-phase-to-ground fault detecting relay, the ratio of maximum single-phase-to-ground fault to relay setting should not exceed 17/1. This is independent of the phase-fault currents. For example, the minimum phase-fault current may be more or less than the maximum ground-fault current without affecting the relay system.

Partial differential schemes are sometimes employed for some buses where there are a large number of feeder circuits equipped with reactors. Linear Couplers may be used with considerable advantage in many such cases.

•

Chain Conveyor Removes Ashes

Twenty years successful operation of a home-made ash-removal system has proved its efficacy at the 3,750-kva. generating station of the Orange & Rockland Electric Company at Monroe, N. Y. At the time of its installation there appeared to be no ash-removal equipment which was geared to the relatively small size of the plant or obtainable at a price that would not have resulted in carrying charges exceeding the cost of removal by hand. Consequently, the conveyor shown was built by the plant forces. It has given good performance at low upkeep cost.

Ashes are dumped in the gutter by the traveling conveyors provided under the boilers. The gutter conveyor then pushes the ashes toward and up the steel incline, whence they drop off into a truck, which then hauls them away. The motor is a 5-hp. one and is geared down to drive the belt at about 20 ft. per minute.

•

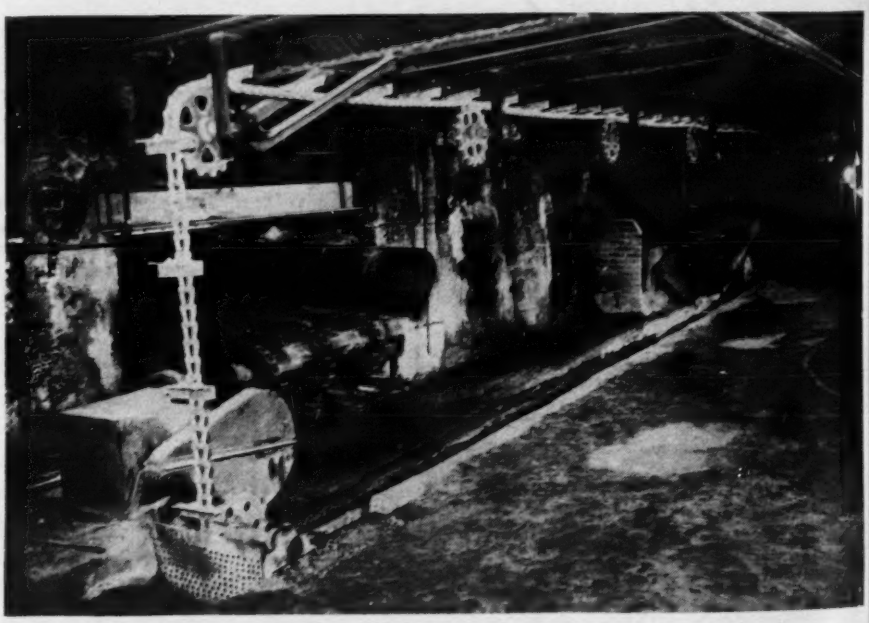
Unit Substation Cost Data

(From an Eastern utility's field construction sheets)

One 1,500-kva. unit type, outdoor substation, 13-kv. to 4-kv., suburban area:	
Land	$ 281.39
Foundations, including labor on same of $483.87	1,553.61
One 1,500-kva. power transformer, 3-phase, complete unit	15,177.30
Stock room expense	52.39
Transportation	113.76
Clerical work and supervision	331.91
Insurance and taxes	23.23
Miscellaneous expenses	2,530.13
Company labor	533.38
Total substation unit	$20,597.10

Riser Construction in Vicinity
2 poles—13 and 4-kv. cable connections

Kerite cable, 219 ft. No. 2 (1941 job)	$ 174.53
Kerite cable, 318 ft. 700-MCM	442.76
Weatherproof wire, 145 lb. 250-MCM	18.85
Single-conductor potheads, 3 15 kv.	68.40
Three-conductor potheads, 1 15 kv.	48.45
Single-conductor potheads, 1 7.5 kv.	69.84
One 40-ft. pole	18.17
One 35-ft. pole	12.60
Fiber conduit, 14 ft. of 5-in.	3.36
Compound	11.87
Anchor and rod	2.34
Miscellaneous material	14.57
Stockroom expense	83.51
Insurance and taxes	15.81
Transportation	7.98
Engineering expense	68.28
Clerical and supervision	25.65
Company labor	221.73
Total riser work	$1,308.70



SPROCKETS and endless chain carrying pushers transport furnace ash to dump car

FLUID TRANSPORT

"PIPING"... the Nation's 5th Carrier

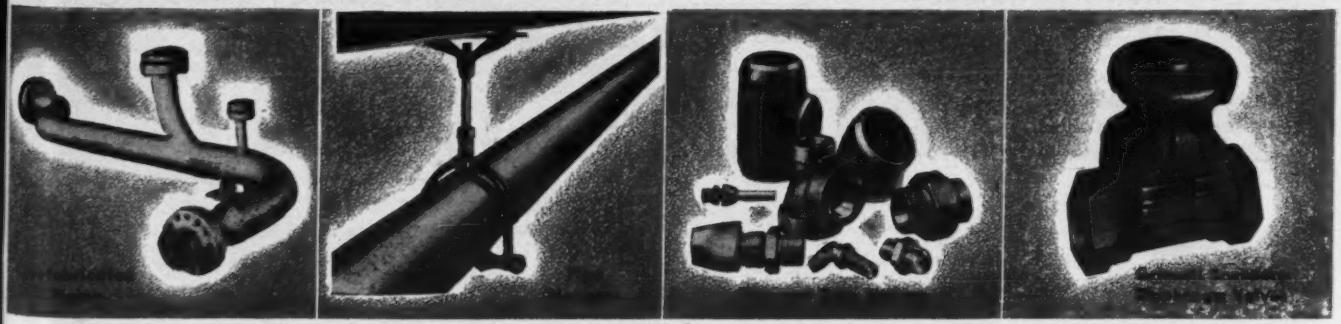
SEAGOING PIPING TAKES AN EXTRA BEATING. Piping must be properly engineered and fabricated to withstand all the punishment that goes with a high pressure steam installation *plus* the extra shocks of rough seas.

Grinnell is meeting these and similar extreme demands for specially engineered piping systems both afloat and ashore. Grinnell plants offer the most modern facilities for fabricating the connecting links which convert a pile of pipe into a complete piping system for efficient FLUID TRANSPORT.

For new war construction and maintenance and repair of existing piping, call Grinnell Company, Inc., Executive Offices, Providence, Rhode Island. Plants and offices throughout the United States and Canada.

GRINNELL

WHENEVER **PIPING** IS INVOLVED



HOW TO CONNECT COMPOSITION CONDUITS FOR UNDERGROUND SERVICE

By I. C. DIETZE, Engineer, Bureau of Power and Light, City of Los Angeles

Methods and illustrations are presented for connecting utility's fibre duct to consumer's conduit of Transite or Nocrete; the ducts being the same size or smaller or larger than the conduits. Another illustration shows the kind of joints to use on conduit from the pull box to the connection with the utility's duct.

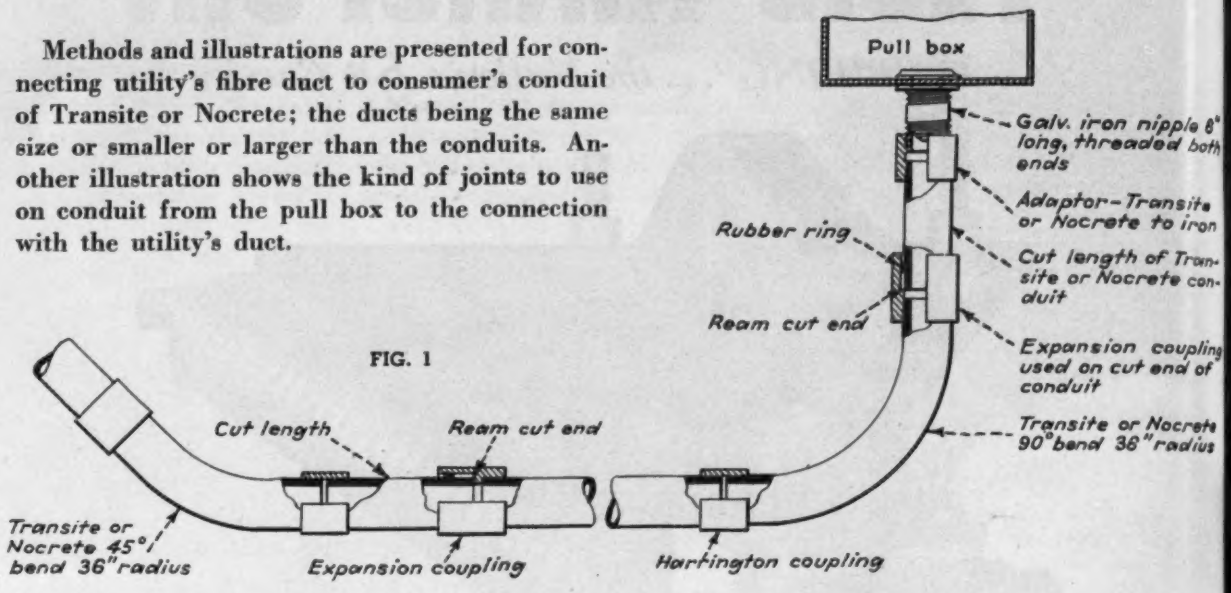

Pull box
Galv. iron nipple 8" long, threaded both ends
Adaptor—Transite or Nocrete to iron
Rubber ring
Cut length of Transite or Nocrete conduit
Ream cut end
Expansion coupling used on cut end of conduit
Transite or Nocrete 90° bend 36" radius
Cut length
Ream cut end
Transite or Nocrete 45° bend 36" radius
Expansion coupling
Harrington coupling

FIG. 1

FIG. 1—Types of joints used on Transite or Norcrete conduit. An expansion coupling may be used in place of Harrington coupling when no tapering tool is available to taper the cut end of Transite or Nocrete conduit. A center make-up connector may be used when there is not sufficient longitudinal movement in conduit to permit use of other types of couplings. Ream all cut ends of Transite or Nocrete conduit. Seal all tapered joints with approved sealing compound.

FIG. 2—Method of connecting consumer's Transite (or Nocrete) conduit to utility's 2-, 2½- or 3-in. fibre service duct which terminates in a galvanized conduit (G. C.) nipple. Remove G. C. nipple and connect Transite (or Nocrete) conduit to fibre duct with "Transite (or Nocrete) nipple 'Fibre duct to Transite (or Nocrete) coupling.'" After approval by inspector, the joint is covered with concrete.

FIG. 3—Method of connecting consumer's Transite (or Nocrete) conduit to utility's 3-in. fibre service duct which terminates in a fibre coupling.

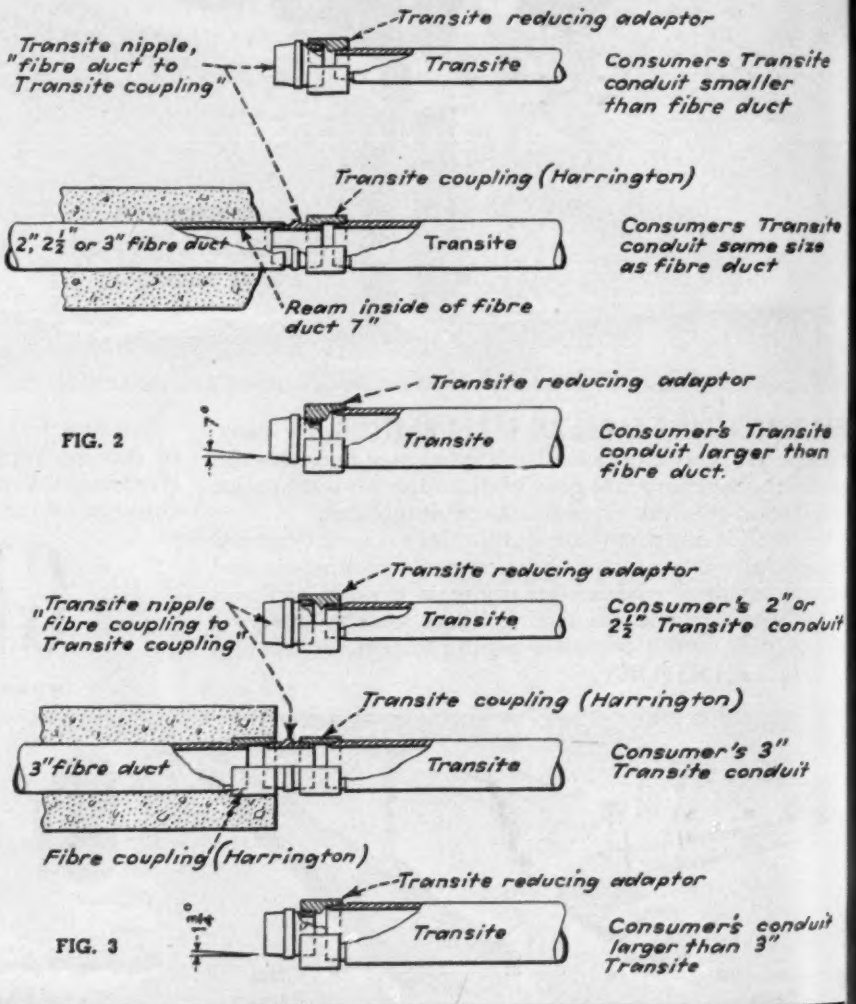


FIG. 2

FIG. 3

You can rely on Pole line Hardware that bears the L-M trademark

LM

✓designed the way you want it

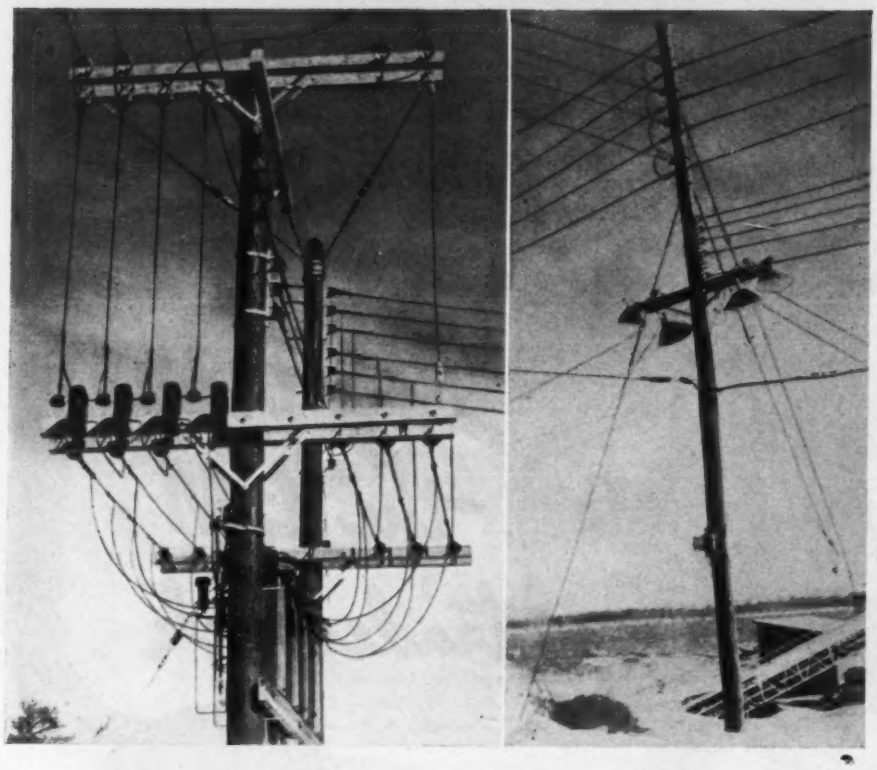
✓built to last

✓packed for convenience

✓RIGHT in ALL WAYS

LINE MATERIAL COMPANY

Saving Material in Army Camp



Economical use of material also saved money and time in the recent construction of an army camp in the East, on a day and night basis. At a typical 4-kv. distribution circuit junction (left) two poles sufficed to carry the incoming primary circuit, a transformer bank on two channel irons bolted to the poles, three outgoing secondary circuits with racks, cutouts and lightning arresters with guy attachments, leaving climbing space.

Use of secondary brackets on one pole did away with the need of double crossarms at that point. Incoming primaries were deadened at the top arm of the nearer pole, vertical runs being carried to a lower arm with taps to the cutouts and thence to horizontal pole buses from which connections run to the transformers and arresters. A similar secondary bus set-up was made at the right, with inter-arm vertical guying and diagonal guying above. At (right) a single pole with four guys was used to carry an incoming 4-kv. line, with branches at right and left secured by strain insulators bolted into the pole; secondary brackets, a communication aerial cable and four floodlights with switching facilities for night construction work. Only two crossarms were required, these supporting the floodlights.

The foregoing construction proved both simple and rugged for the conditions and contributed to speed of erection at a time when additional accommodations for selective service men were at a premium.

•

How an Electron Tube Functions*

By W. C. WHITE
Engineer in Charge,
Electronics Laboratory, General Electric Company

Electronics is defined as "the science which deals with the behavior of electrons." I rather like a definition which reads "electricity freed from the bondage of wires."

The words "electron tube" and "vacuum tube" are used to describe the same device, it being largely a matter of personal preference which term is used.

What goes on inside a high-vacuum electron tube utilizes two basic components. The first is some source of free electrons and the second includes elements so that the motion of the electrons can be definitely guided.

Heating a metal red hot inside of a highly evacuated bulb liberates electrons from the surface.

That red-hot piece of metal emits a cloud of electrons which may be caused to move toward a positively charged terminal placed inside the bulb. Therefore, electrons pass from the hot plate, which is called a cathode, to the cold plate, which is called an anode, and the resulting continuous transfer of electrons constitutes a flow of electric current.

This electronic method of conducting electric current offers possibilities of controlling the current in ways that are totally impossible in an ordinary conductor like a piece of wire because these electrons may be started, stopped and deflected very easily. This is done by putting additional electrodes in the tube and operating them at a certain combination of voltages which determines how many of these electrons travel across the space and at what speed and how often they are started and stopped.

Because such a huge number of electrons is required to carry an appreciable amount of current and because they move so rapidly, the flow of current through the tube can be subject to variations of an extraordinary degree as regards speed and nature of the variation and control.

The control element in the tube is usually like a screen or grid which is placed directly across the stream of electrons.

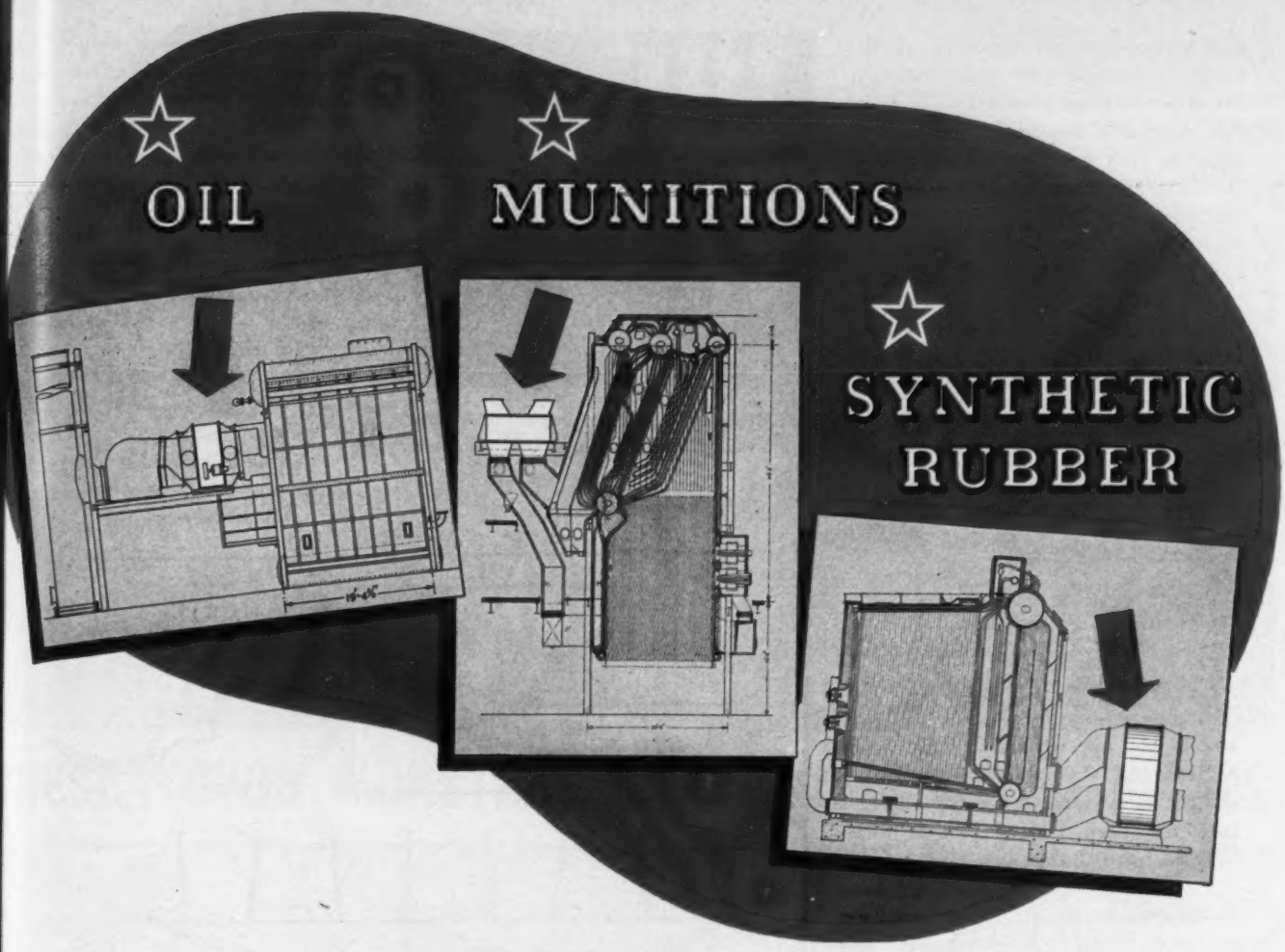
If to this grid or control electrode a proper voltage is applied, the current through the tube, and thus the current in the circuit, may be varied. The kind of tube used depends on the magnitude of the currents and voltages involved and how fast the control has to be, and it can easily be up to a billion times a second.

An electron tube can function at millions of cycles a second just as well as at 60 cycles, because the myriads of electrons in the evacuated space inside the bulb can move at such enormous velocities that the frequency range mentioned above is slow compared with the time required for them to move from one electrode to another.

Electron tubes are unique in their ability to control electrical current smoothly. Most devices that are used to vary an electric current do it step by step. The charge carried by each electron is so exceedingly small that the rhythmic increases and decreases of current to reproduce music or the human voice are easily, accurately and smoothly accomplished.

Electron tubes are able to control

* Adapted from a recent Science Forum broadcast.



Vital war plants boost heat-recovery, save fuel, with Ljungstrom Air Preheaters

PROCESS industries at the heart of the war program are powered by Ljungstrom-equipped boiler plants. The reason? The Ljungstrom Air Preheater combines high operating continuity *with maximum conservation of fuel and steel.*

• • • • •

With preheated air, combustion is more efficient, and poorer grades of fuel can be utilized. Waste-heat becomes an output booster.

In transferring heat from flue gases to incoming air, the Ljungstrom operates on a *continuous regenerative counterflow* principle that permits a reduction of ½ or more in the weight of heat transfer surface, compared to other types. Steel is saved, erection is simplified, and a higher heat-recovery level becomes practical despite today's limitations on construction materials.

In addition, the Ljungstrom has established high records for continuity of service, and normal maintenance is quickly and easily carried out. Gas temperatures as high as 1600°F are being successfully handled in installations in the process industries.

If you have a problem involving gas-to-air heat transfer, why not ask our engineers for application aid. On boiler plants, all major builders are prepared to incorporate the Ljungstrom in their designs.

THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York, N. Y. • Plant: Wellsville, New York

the movement and velocity of the speeding electrons by merely changing the electrical potential of one of the electrodes inside the tube. This requires only a very small amount of electrical power. This is just another way of expressing the well-known fact that electron tubes are amplifiers and can reproduce, at a greatly increased power level, the impulses fed to them.

The fourth feature is their ability to pass current only in one direction, or, as it is often expressed, to act as a rectifier.

•

Transformer Radiator Drain Device

By E. H. COXE, Jr.
Electrical Engineer, Aluminum Company of America, Alcoa, Tenn.

Faced with the frequent necessity of draining transformer radiators which are not provided with drain valves, the special valve assembly shown in the accompanying illustrations has been devised. These radiators do have drain plugs, but removing them and attaching an oil hose is always a messy procedure resulting in considerable loss of oil and patience.

The assembly consists of a standard pipe "tee" having a "vee"-shaped flange welded to the top, a standard valve and flexible oil hose connected to the side or tap and packing gland and shaft screwed into the bottom. This shaft can slide lengthwise through the packing gland and has on its inside end a socket wrench which fits the radiator drain plug.

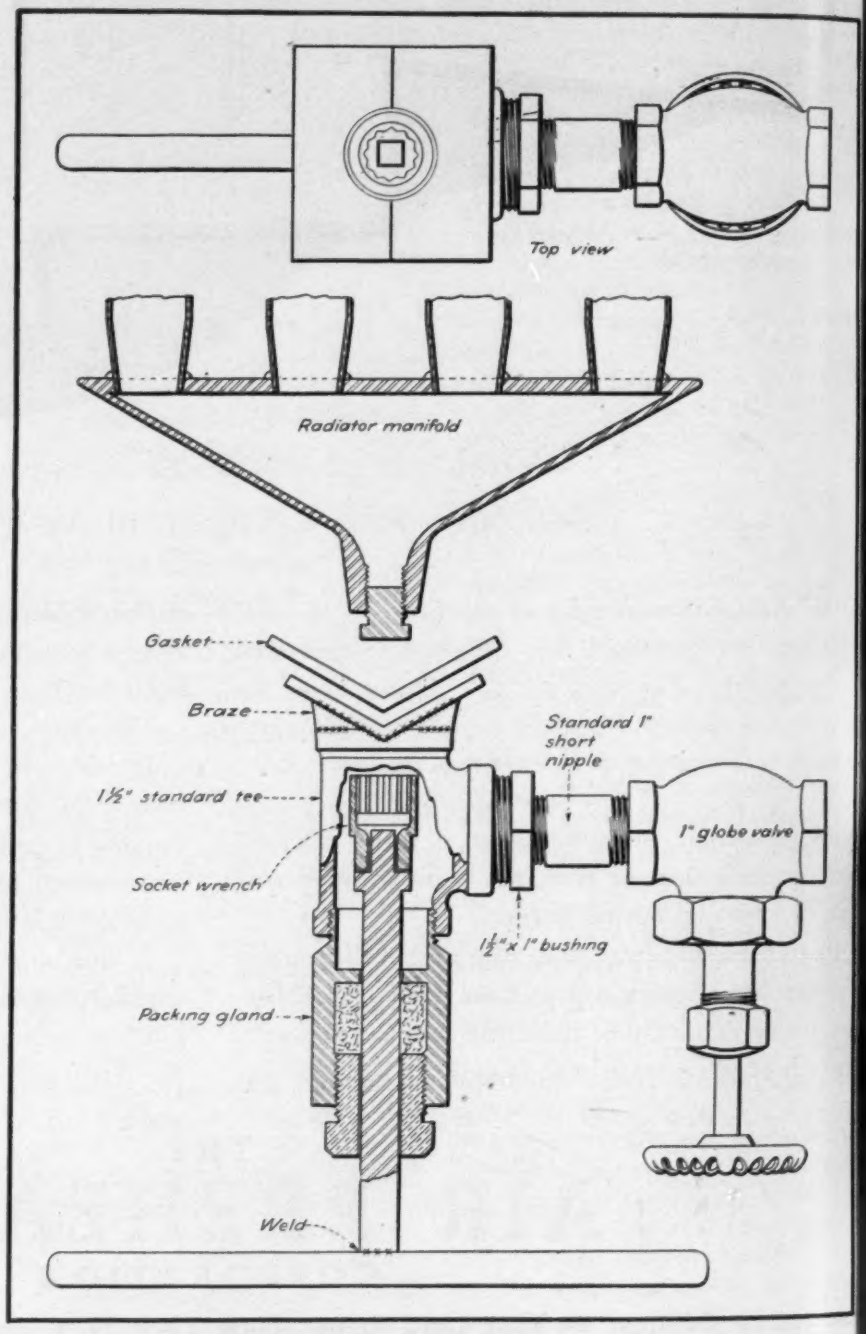
In applying the device it is fitted over the drain plug with a gasket between its flange and the radiator "vee" bottom, and is held firmly in place with clamps extending under the flange, over the lower radiator manifold and between the radiator tubes. The flexible hose is connected to the container or piping system which is to receive the oil; the valves between transformer and radiator are closed; the drain plug is removed with the socket wrench inside the "tee"; the plug in the top of the radiator is removed for the admission of air, and the oil flows away without a drop being spilled.

Alternatives to the use of this device are (1) the above-mentioned oil-spilling procedure of removing the plug and then attaching a hose,

CLAMPS hold the Vee-shaped and gasketed top of device against radiator drain plug

(2) draining the whole transformer, a time-consuming procedure which necessitates removing the transformer from service, or (3) installing drain valves on all radiators, an expensive procedure where a large number of transformers are concerned and of questionable justification during the present material scarcity.

The device can be attached in ten minutes by a mechanic and helper, and removed in half of this time. It is readily adaptable to different types of radiators and can be made in any machine shop out of scrap material. It is possible to assemble the packing gland completely from pipe fittings without machine work.



PIPE-FITTING ASSEMBLY drains oil without spilling

THESE TOUGH MONSTERS CAN'T MOVE WITHOUT THIS

THE breaker arm found in the ignition system of every gasoline driven engine is generally made of Formica because Formica is light, strong, water resistant, wear resistant, temperature resistant, dielectric and can be machined precisely.

specific gravity 1.34
tensile strength 8000
flexual strength 16,000
compressive strength 34,000
water absorption 1.3%
dielectric constant 5.0

Figures are for grades used for breaker arms. Other grades have different properties.

- These properties have made Formica valuable for many mechanical and electrical uses, and suggest many new peacetime applications.
- Other grades of Formica have special acid, alkali, and solvent resisting properties for purposes where those qualities are important.

THE FORMICA INSULATION COMPANY, 4630 SPRING GROVE AVENUE, CINCINNATI, OHIO

ONE METHOD FOR SPECIFYING TREATED CROSSARMS

These specifications cover the selection of timber, manufacture and treatment of dense Southern pine crossarms and are adapted from a book of standards of the New England Power System

1. SPECIES AND QUALITY OF TIMBER

Crossarms shall be of the best quality dense Southern pine and shall be free from all defects in excess of those allowed below. Each shall show on one end or the other an average of at least six annual rings per inch and at least one-third summer wood. The contrast between the spring and summer wood shall be sharp as specified by the Southern Pine Association. No limitation is placed on the relative amount of heartwood and sapwood.

2. SEASONING

Cross arms may be air or steam seasoned. In any case, if the moisture content exceeds 18 percent of the oven dry weight, the arms shall be steam seasoned before treatment. Air seasoned arms must be carefully inspected for evidence of decay immediately before treatment.

Steam seasoning shall be accomplished by steaming before treatment at temperatures not over 260 F. The pressure and temperature shall be gradually increased so that the above maximum is not reached in so short a time as to induce checking or separation of the annular rings. Such steaming shall continue until, in the judgment of the treating engineer, the temperature of the crossarm shall have reached 180 F. and it will be possible to secure the penetration herinafter specified.

After steaming is complete, a vacuum of not less than 22 in. shall be drawn for not less than fifteen minutes, during which the condensate shall be drawn off at intervals to prevent accumulation in sufficient quantities to reach the timber.

3. MANUFACTURE

Crossarms shall be completely manufactured in accordance with the best commercial practice before treatment. The dimensions (with their respective allowable variations) and the dressing, roofing, boring, etc., shall be as shown on the drawings specified in the purchase order. The arm shall be manufactured so that the heartwood occurs at the bottom whenever possible.

Pin and bolt holes shall be smooth and free from excessive splintering where the bit has broken through. Crossarms not conforming with this specification shall be rejected, and the manufacturer shall either replace such rejected arms with arms complying with this specification at his own expense, or shall allow credit for such rejected arms.

Holes properly bored shall not admit, without forcing, a gage having a diameter equal to the specified diameter of the hole, but shall admit a gage 1/32 in. smaller than such diameter when tested immediately after boring.

4. DEFECTS

Finished crossarms shall not contain any of the following defects:

A. *Knots*—Loose, encased or unsound knots of any size and knot clusters shall be cause for rejection. The least diameter of any knot within 2 in. of the center bolt hole shall not exceed ½ in. The sum of the least diameters of all knots plus bolt or pin holes in any other 2-in. longitudinal section shall not exceed 1 in., plus 1/16 in. for each inch along the crossarm from the center bolt hole to the center of the section under consideration, with the exception that no knot shall exceed 2 in. in diameter. In cases where knots occur near the center of any face and the pitch is contained within the arm, the inspector may pass knots 50 percent larger than is allowed by the above rule (keeping, however, within the 2-in. maximum), if in his opinion the crossarm is not thereby weakened.

The above knot restriction applies on all arms except those arms which are more than 1/16 in. undersize in depth. Such arms may be accepted if not more than 3/16 in. undersize and if no knots occur within 8 in. of the center bolt hole.

B. *Diagonal Grain*—Slope of the grain on any face of the crossarm shall not be greater than the slope of the diagonal of that face unless the pitch appears near the center of both ends, in which case the slope may be 1 in. in each 15 in. of length.

C. *Wane*—Wane is permissible outside the carriage bolt holes on arms, provided the cross-section is reduced not more than 5 percent and no wane occurs within 1 in. of any pin hole. No wane is permitted on high-voltage arms. Bark shall be carefully removed from any wane so permitted before treatment.

D. *Decay and Worm Holes*—There shall be no evidence of any kind of decay. The presence of worm holes will be cause for rejection.

E. *Shakes and Checks*—Ends of the crossarms shall not show loose heart, shakes or splits. Longitudinal checks exceeding 12 in. in length, or ¾ in. in depth, or which may affect the strength or durability of the arm, are not allowed.

F. *Pitch Pockets*—Pitch pockets shall not be longer than 2 in. or larger in area than 2 square inches. These pockets must not enter pin or bolt holes, nor appear on more than one face of the arm.

G. *Warp*—Warp is permitted in one plane only and shall not exceed 1/10 in. per foot of total length of arm.

5. PRESERVATIVE TREATMENT

Crossarms shall be treated by the Rueping empty cell process with initial air, with AREA Grade No. 1 creosote oil. The initial air pressure, length and pressure of treatment, and final vacuum shall be so arranged as to obtain 100 percent penetration of all treatable wood with a final retention of 6 lb. of creosote per cubic foot of wood.

6. STEAMING AFTER TREATMENT

All crossarms shall be steamed at 15 lb. pressure for 20 minutes, either immediately after treatment or after reaching ambient temperature, at the option of the inspector. After steaming, a vacuum of not less than 22 in. shall be drawn.

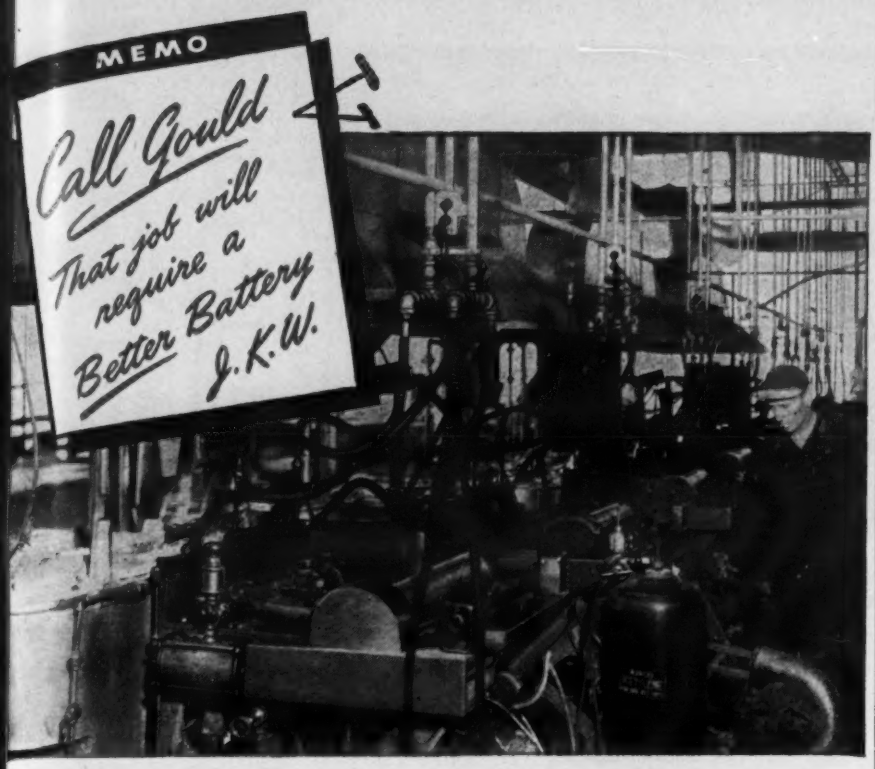
7. INSPECTION

Inspection will be at treating plant unless otherwise specified. If inspection is at destination, 15 days shall be allowed after crossarms are received to make inspection, and notice of rejection shall be mailed to vendor within 20 days after crossarms are received. Rejected arms shall be held subject to vendor's instructions for 30 days after notice of rejection is mailed, after which time, if no shipping directions have been received by the consignee, they may be disposed of. Inspection or waiving of inspection shall not relieve the manufacturer from obligation to furnish material in accordance with these specifications.

Crossarms rejected under Par. "A" and "B" above may be accepted if they withstand a mechanical test to be specified by the inspector.

8. STORAGE

Crossarms held for storage shall be stacked in cross piles on skids in such a manner as to insure good ventilation. The stacks shall be roofed to prevent the penetration of rain or the direct action of the sun.

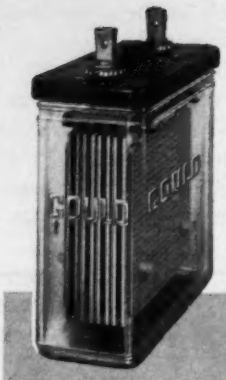


CUSTOM BUILT WITH MASS PRODUCTION ACCURACY

• Most industrial storage batteries are designed and made for a particular job. They are not mass produced in quantity. However, certain mass production techniques worked out by Gould engineers have been applied to many important steps in the manufacture of Gould industrial batteries. These have resulted in greater uniformity of product and a higher standard of quality.

For instance, the Gould grid casting machine pictured here has upped production from approximately 2,000 per day for the hand casting operation to 5,000 per day per machine, and the finished product is better.

When your industrial battery is Gould designed and Gould manufactured, it is a guarantee of longer battery life and more economical operation.



SPECIFY GOULD PLANTE.. The battery with antimony free positives for control and standby applications.

Rated Conservatively . . . *Goulds equal or exceed in capacity any battery of comparable size and cell structure.*

GOULD STORAGE BATTERY CORPORATION, DEPEW, NEW YORK

Builders of industrial batteries for every application. Sales and service offices in principal cities of the U.S.A.

Factories at Depew, N. Y., North Bergen, N. J., Dallas, Atlanta, Chicago, St. Paul, Leavenworth, Los Angeles

FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT

GOULD

Since 1898 THE BATTERY PICKED BY ENGINEERS

DON'T OVERTAX YOUR BATTERY

One of a series of service suggestions for users of industrial batteries.

▶ Your storage battery is made to do a specific job, and its manufacturer rated it accordingly—so many ampere hours at the 8 or 6-hour rate, as the case may be. It is an accepted practice to work a battery to its full capacity. Regular full capacity discharges keep a good battery "awake", and actually stimulate its action so that it performs well for a long trouble-free life.

But here's the "But": Don't overwork any battery consistently. Don't discharge, as a matter of routine, beyond the rated capacity of the battery unit. Goulds can and will give more than rated capacity and will do so continuously for a long period of time. However, when discharges are carried beyond the point of rated capacity, an unusual strain is imposed on grid members, and this strain tends to shorten grid life.

The cause of this strain can be traced to the active material. In the positive plate, lead peroxide (the synthesis of the material when charged) has a smaller volume than the lead sulphate which forms as the battery discharges. From this it can readily be seen that since there is a change in volume, an expanding and contracting action takes place as the battery charges and discharges.

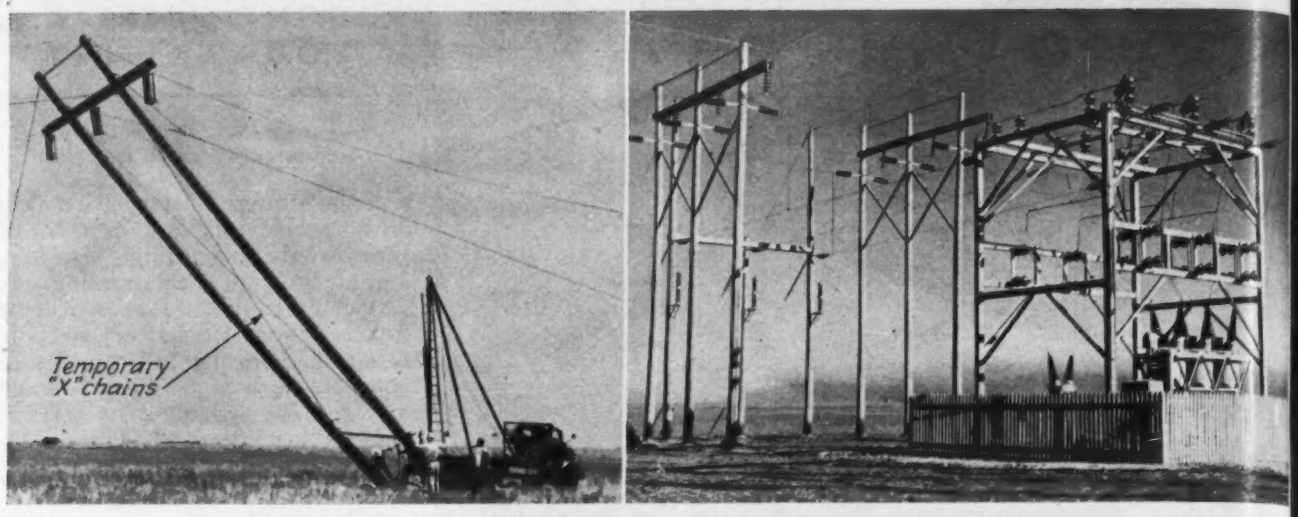
This is the point: Your battery manufacturer allows for this action, basing his design on the capacity of the unit involved. However, discharges beyond the rated point cause a further expansion, and consequently a greater contraction on charge. In an emergency it is permissible to discharge beyond the point of rated capacity, but *only* in an emergency. Continued use of any battery beyond this point amounts to direct abuse and must be avoided.

We would like you to know the Gould men who will take care of your industrial storage battery requirements.

Serving a number of states in the southern Mississippi Valley are W. H. Burkey, Sales and Service Manager, at 1218 Olive Street, St. Louis, Mo., and J. F. Bursh of 1901 So. Fourth Street, Leavenworth, Kansas. Somewhat farther west and south is R. G. Lawrence at 4935 Cass Street, Dallas, Texas.

Gould also has two factories in this same area, one located at Leavenworth, Kansas, and the second at Dallas, Texas.

[Advertisement]



METHOD of erecting completely assembled tangent structures. Insulator crates are removed by clipping two banding wires (left). Line tap and switching structure. Note static wires carried over wood structure (right)

Practical Design for War-Born 66-Kv. Line

Typical of the common-sense design that marks many new war-born wood-pole transmission lines which have sprung up is a recently completed 20-mile, 66-kv., single-circuit line of the Southwestern Public Service Company, Amarillo, Tex., pictured in the accompanying illustrations.

This line, while now operating at 66 kv., has been designed for future operation at 115 kv., with extra insulation added. Consideration has been given in the design to the rather serious ice storms, high winds and frequent electrical storms common to this area of Texas.

Present conductors installed on the line are 3 K Copperweld. However, ultimate design calls for 0.530-in., type S Copperweld. The line is protected throughout its length with two $\frac{5}{16}$-in. high-strength, seven-strand static conductors which are extended over the two substations and one switching structure associated with the lines. The static wire is grounded at all tangent structures. Special structures, such as railroad crossings, dead-ends and 90-deg. angle structures, however, have no pole grounds. This maintains a high impulse value over the entire line.

Poles are class 3, 60-ft. cedars, with $\frac{1}{2}$-in. Pentrex butt treatment, mounting double 3 x 10-in. x 26-ft. fir timbers as arms. Arms are treated to 8 lb. retention with pentachloral-phenol.

In building this line structures were assembled on the ground and raised as a unit, using two trucks and 14 men. Temporary "X" chains were installed prior to erection of the structure to prevent its folding to one side or the other during erection. These chains were attached around the pole at the arm, crossed one over the other and attached to the opposite pole butt just above the metal spacer pipe, also attached prior to erection. Slack was taken out of the two lines by means of small "tuggers." This permitted the structure to be "squared" as it lay on the ground by adjusting the chain length, and also to plumb the "H" structure before earth was tamped around the poles.

All dimensions for drilling the poles were specified from the butt. Any over-run or under-run in length was permitted to occur above the static wire support angle iron. Thus it was only necessary to level the bottom of the two holes and the structure could be set with reasonable assurance that the crossarm would be level. Insulator strings fastened to crossarms before the structure was raised were protected from damage by their crates. These were easily removed at the proper time by clipping two banding wires.

The line was built at a cost of $3,777 per mile, including right-of-way, surveying and engineering. This figure is somewhat higher than it would have been had the line not been built under adverse conditions of delayed material shipments.

Two wood substations associated with the line cannot be shown for reasons of wartime security. The switching structure, however, is pictured. Wood structural members used in the substation were of fir treated to 8 lb. retention pentachloral-phenol.

Since it was considered by supervising design and operating engineers that wood substation and switching structures have advantages over steel structures, particularly where they are protected from lightning with overhead static wires, it is not proposed to replace any of the wood structures of this project with steel, even when it again becomes available.

Labor Summary

20-Mile, 66-Kv., Wood-Pole Line

Item	Unit	Man-Hours
1. Staking structure locations	Structure	1.01
2. Digging holes (Powered earth drill)	Hole	0.83
3. Unloading, hauling, scattering poles, timbers, hdwe., insul.	Structure	5.96
4. Assembling special structures such as corners, D. E., etc., including insulators	Structure	7.89
5. Assembling plain H-frame tangent, and transp. st., including insulators	Structure	6.31
6. Raising, setting, tamping structures, incl., banking poles and cleaning sites	Structure	10.19
7. Complete installation of guys and anchors	Structure	42.58
8. Unloading, hauling conductor	Mile of line	7.53
9. Stringing, sagging, splicing, dead-ending, clipping in conductor	Mile of line	136.68
10. Unloading and hauling static wire	Mile of line	2.65
11. Stringing, sagging, splicing, clipping in static wire (Part installed with conductor hot)	Mile of line	65.10
12. Grounding (Per pole 0.33 man-hours)	Mile of line	7.19
13. Misc. labor — Guards, etc.	Mile of line	38.90
14. Eng., supervision, construction	Mile of line	38.27
15. Preliminary engineering	Mile of line	15.31
Construction labor	Mile of line	563.89
Engineering — Preliminary construction	Mile of line	53.58
All operations	Mile of line	617.47

When ignorance is blistered!

● It's the ignorant men who make costly mistakes. Trained men don't get hurt by small fires. Trained fire-fighters don't let little blazes grow into big ones.

The way to train workers in fire extinguishing is by demonstrating use of extinguishing equipment. Show how to handle real fires. Show how various types of extinguishers are handled on different kinds of fires.

Walter Kidde & Company has prepared a booklet—"How To Teach Fire-Fighting." It tells how to stage a fast-moving, interesting, instructive fire class. Write for your plant's copy.

Walter Kidde & Company, Inc.
725 Main Street **Belleville, N. J.**

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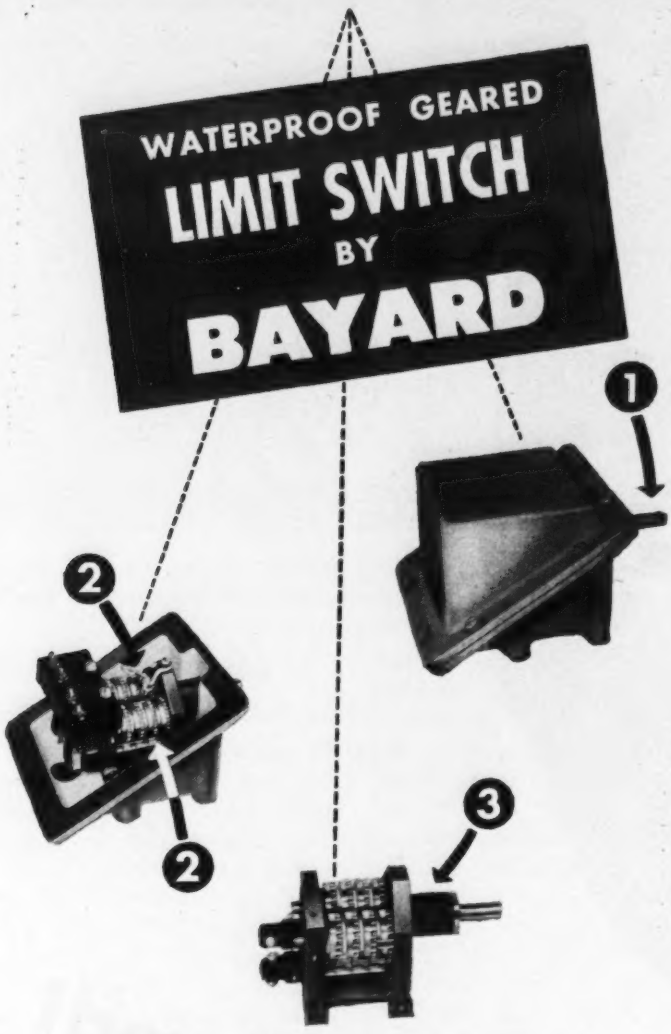
PROTECTS LIVES
HIGH PRESSURE GASES • FIRE PROTECTION



Suitable for handling normal control currents. Adjustable between 1 and 3333 revolutions—for speeds up to 1200 rpm.

1. ***Only this shaft is attached to moving machinery—easy to get to—easy to attach and detach.***
2. ***Only top of housing is removed to set—no need to disturb mechanical or electric connection. Wiring is easy, too—requires no disconnecting of mechanical connection or setting.***
3. ***Working unit is simple, self-contained and easily removable.***

BAYARD

The second star of continued achievement has now been added to the Bayard Navy "E" Pennant.

M. L. BAYARD & CO., Inc. • ENGINEERS • MACHINISTS • PHILADELPHIA

The switching structure, shown, was built at a cost of $15,600 complete, including oil circuit breaker, operating transformer, as well as all materials and equipment, including right-of-way for the structure.

Transmission structures as well as the two wood substations and the one switching structure were built by Hughes Brothers to specifications laid down by the Southwestern Public Service Company.

•

Series Capacitors—Where Place? How Big?

Voltage Rating*—VII

By S. LUBIN
Engineer, REA Technical Standards Division

A.—Line to Ground Voltage Rating

The insulation to ground of the series capacitor should be co-ordinated with line insulation. In general, the potential between the capacitor terminals and ground will be greater than the voltage drop across the capacitor itself. Standard capacitors can be mounted on insulators rated at line voltage, or specially built capacitors can be obtained having the proper insulation between terminals and case. The choice between these two types will depend on cost and ease of mounting. It will usually be found more economical to mount standard capacitors on insulators, but from the standpoint of safety a grounded case is more satisfactory despite the higher cost.

B.—Terminal to Terminal Voltage Rating

The voltage drop across the capacitor is dependent on its reactance and on the load current flowing through it. In order to determine the terminal-to-terminal voltage rating the following information is required:

1. Full load line current.
2. Peak line currents due to motor starts.
3. Maximum short circuit current through the capacitor.

Momentary voltage rise of 150 percent of the nominal rating is permissible on series capacitors. The terminal-to-terminal voltage rating may be based either on peak current due to motor starts or on maximum

*This series began in the April 17, 1943, issue of "Electrical World."

UNIV. OF CALIFORNIA

THE "MAGIC BRAIN" OF Any Electronic Equipment IS A TUBE...

and the fountainhead of modern tube production is RCA

LET'S LOOK AT THE RECORD!

To a greater degree than any other manufacturer, RCA has solved the problem of turning out in quantity, high quality Tubes expertly engineered to the requirements of the practical user. In the field of "Receiving" Tubes, RCA is looked to by the government as well as many other critical customers as producing an eminently satisfactory product—and doing it in tremendous quantities.

In Cathode-Ray Tubes, RCA was the first to produce well-engineered units at low cost, thus making them available to industry generally. RCA has long led in Phototube development, meeting one newer and more exacting application after another. Included here as RCA "firsts" are such outstanding developments as the RCA-931 Multiplier Tube, and other Phototubes utilizing the famous S4 surface which is highly responsive to daylight and blue light.

RCA first developed the Beam Power Tube in the "Receiving" field, subsequently carrying this important development into the field of Transmitting Tubes.

In the field of Ultra-High-Frequency Tubes, RCA was the first to bring out Acorn Tubes—and, later, many others, among them such important Tubes as the RCA-1628 (and its successor, -8012), -825, -827 and RCA-832.

In Power and Transmitting Tubes, RCA was the first to design a successful air-radiator for cooling heavy-duty units.

Time and again, RCA has anticipated the need for new or improved Tube types, often pioneering them far ahead of any commercial demand.

And always RCA has led the way with Application Engineers in the field. These practical men apply their specialized talents to the dual objective of developing better tubes for the job at hand, and finding ways to use tubes already available to better advantage.

BUY U. S. WAR BONDS AND STAMPS

RCA RADIO-ELECTRONIC TUBES

RCA Victor Division, RADIO CORPORATION OF AMERICA, Camden, N. J.

DANGER KEEP OUT

Protection against high voltage current is essential to power plant personnel every hour of the day *and night*. So use the equipment that does 'round-the-clock duty...Bendix-Cory* Interlocks.

Installed on the protecting door and controlling oil switch of a high tension bus, these never-sleeping watchmen assure absolute safety of operation at all times. Entrance to the bus is *impossible* while the oil line switch is *closed*. You have to *open* the switch to release the key which unlocks the door to the bus.

By means of Bendix-Cory Interlocks, any number of points can be *interlocked* in the above manner, thus eliminating the human element and providing a positive safeguard against mistakes, lapses of memory and other common causes of accident.

Write for full information on both indoor and outdoor applications of Bendix-Cory Interlocks.

*Trade Mark of Bendix Aviation Corporation and Subsidiaries

The Bendix-Cory Interlock is a member of "The Invisible Crew" — precision equipment which 25 Bendix plants from Coast to Coast are speeding to world battle fronts.

THE INVISIBLE CREW
Precision Equipment by
Bendix
AVIATION CORPORATION

MARINE DIVISION · One Hanson Place, Brooklyn, New York

short-circuit current. The choice between these two will be dictated by considerations of economy. If the peak-line current is used, then it may be necessary to provide automatic shorting switches to by-pass the capacitor on short circuits. On the other hand, calculation of rating on the basis of the maximum short circuit current may require a higher capacitor rating. The cheaper of these two methods will be the one to be used. The terminal-to-terminal voltage rating is determined by use of the following formulas:

$$V_P = X_C I_p \qquad (5)$$

where: V_P = Voltage rating for instantaneous peak currents
X_C = Capacitor reactance (ohms)
I_p = Peak line current (either due to motor starts or to short circuit)

then:
$$= \frac{V_P}{1.5} = 0.67\ V_P \qquad (6)$$

where: $V_.$ = Voltage rating of the series capacitor.

Crepe Paper for Transformer Leads

By STEPHAN LIGETTE, Sr.
Westinghouse Electric & Manufacturing Company, Sharon, Pa.

Tape made from crepe paper, much like that used for decorative purposes, is now used to tape transformer leads, replacing varnished cambric tape formerly used. Cambric tape is comparatively expensive, and for the uses involved the paper serves equally well and is in some respects better.

Cambric cloth treated with varnish, dried and then cut into rolls, is commonly used for taping leads which are insulated by air only. However, where leads from transformer coils to terminal boards are under oil, it is unnecessary to use a material which has a high dielectric strength in air.

The tape now used is made of Kraft paper, which has been creped in much the same manner as the ordinary decorative crepe papers. This paper is rolled full width and then cut into narrow rolls of sizes convenient for taping.

This paper tape is much lighter in weight than the varnished cambric tape and has practically no insulation value of its own. Its high dielectric strength in this application results from the oil soaked up upon immersion. Tests conducted on the cambric

HIGHER VOLTAGE AND BETTER REGULATION

Cut COPPER CONSUMPTION

One way to curb waste and help to remedy the serious shortage of copper and insulating materials is to operate insulated wires and cables at the highest voltage consistent with safety. Every effort should also be made to increase operating efficiency by more effective voltage regulation.

Higher voltage and better regulation on systems now in operation will mean more efficient use of the copper now in service. Most distribution systems were designed with a margin of safety that may justify higher operating voltage for the duration of the war.

A change to higher voltage should be considered wherever replacement or rewiring becomes necessary. If it can be done it will mean a definite saving in copper and may result in more efficient and economical operation.

Plans for new distribution or expansion should be postponed until after the war. If they cannot be postponed, provision should be made for the highest practicable voltages—both primary and secondary.

The cables you already have should be used to the utmost limit of their usefulness. The design and manufacture of new cables are restricted by War Production Board regulations but if you must buy new ones for vitally essential war work we shall be glad to tell you what Simplex insulated wires and cables can do for you.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex
WIRES and CABLES

FOR RURAL EXTENSIONS

Specify Crapo STEEL CONDUCTOR!

TIME-TESTED *Crapo* Steel Conductors are "made to order" for the rural extensions authorized by WPB's Supplementary Utilities Order U-1-c. For these high-strength steel conductors, with their superior 60-cycle alternating-current properties, have proved their efficiency, dependability and economy in rural service all over the country for the last seven years.

Crapo HTC-130 Steel Conductor, in the No. 6 B.W.G. Stranded (3-wire) type adopted for these extensions, is available through Graybar Electric Company, Inc., Distributors. Ask the Graybar representative or contact the nearest Graybar branch office!

WRITE FOR NEW ENGINEERING MANUAL containing complete technical information on *Crapo* Steel Conductors, including electrical characteristics and performance, sag and tension data and applicable construction practices! Address:

INDIANA STEEL & WIRE COMPANY
MUNCIE, - - INDIANA

Crapo HTC-130 STEEL CONDUCTORS

and paper tapes show that they have about the same dielectric strengths when subjected to 60-cycle voltages. However, when subjected to impulse voltages the paper tape was found to have considerably higher strength.

Since lead separation is usually dictated by surge strength of the lead, it has been possible, through the use of paper tape, to reduce the spacing between leads.

Oil-impregnated paper tape has long been used for machine taping and insulating conductors in lead-covered cables because of its high dielectric strength. For these uses taping is done by machine and a straight manila paper is used. Stretch in the paper is not a requirement as only straight cables or conductors are taped by machine.

In transformers leads are bent to conform to the space in which they are located, so it is necessary to use a paper which has a certain amount of stretch to permit taping around the bends. Crepe paper has the wrinkles which meet this requirement and results in a smooth, neat job after the operator masters the technique of winding.

The only adverse feature of paper tape is in the fact that leads taped with it cannot be bent after taping. To overcome this difficulty leads are so supported as to avoid bending after the tape has been applied.

•

Acidity in Indoor Transformers

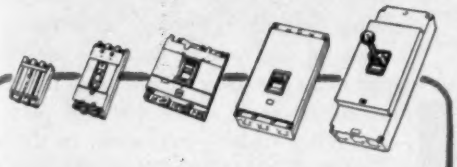
Deterioration of oil in transformers is less the better the ventilation around a transformer and the lower the temperature maintained in the oil. Increased rate of deterioration was found in the indoor installations among 605 distribution transformers of various ratings studied by Messrs. Favell and Cannon and reported in their recent I.E.E. paper on "The Ventilation of Substations." Only a few had conservators and breathers and all were purchased between 1929 and 1942.

The study showed that 26 indoor transformers tended to reflect acidity higher than 0.5 mgm. KOH per gm. of oil at a rate more than 20 times as high as the percentage so found among 579 units installed outdoors. The respective percentages were 23.1 and 1.035.

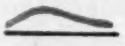
no "A.W.O.L"s here

WESTINGHOUSE NOFUZE BREAKERS ARE ON ACTIVE DUTY—

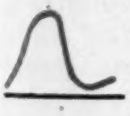
mobilized to protect war circuits



NOFUZE "DE-ION" BREAKERS



prevent *harmless* overloads from interrupting war production.



protect circuits from *dangerous* overloads and "shorts".

restore service *instantly* with just a flip of the switch.

Absent? Yes. Absent for the duration from peacetime applications because the Westinghouse production of Nofuze Breakers is devoted to war requirements.

But far-reaching improvements are resulting from this wholehearted participation. For example, in the new line of "F" Frame Breakers, all ratings from 15 to 100 amperes have been redesigned into one compact frame size. Instead of 14 different models, 4 now serve the same purpose.

In a typical panel, the new breaker results in a saving of 38% of the steel and 18% of the copper over present panels. And although the new breaker is smaller and weighs less than half of some of the superseded units, it has better performance.

Westinghouse engineering facilities have been placed on a broad consulting basis to help with the job of protecting vital war circuits from unnecessary interruptions. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pennsylvania.

J-60522

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

NOFUZE CIRCUIT PROTECTION

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Farm Students Learn to Care for Motors

By H. G. WALT
Rural Service Engineer
Consumers Power Company, Lansing, Mich.

As a service to farm customers Consumers Power Company is emphasizing the importance of electric motor care and maintenance.

One method has been through motor cleaning and repair clinics in agricultural schools. Shown are some of the 59 students of the James Couzens Agricultural School at Bath, Mich., who received practical instruction and watched demonstrations during the clinic in that school. There have been other clinics in Mason, Olivet, Charlotte, Eaton Rapids, Dansville and Haslett high schools of the Lansing Division, and similar projects have been instituted in other electric divisions of the company. To date 383 agricultural students in the seven high schools mentioned have learned how to clean and oil a motor, how to protect it from damage and how to make repairs.

To date 19 motors have gone through the clinic. Three have gone on to repair shops for further repair, and the others are back on the job.

One objective in planning a clinic is to have at least two types of motors brought in from farms by the boys. This makes a more effective clinic, because every one knows that the rural service engineer does not have a "canned" demonstration. First, the reasons and objective of the clinic are explained. Then, after naming the types of motors, each motor is dismantled to show construction details, calling special attention to bearings, brushes, commutators, oiling systems, dirt, etc. Each part of the motor is cleaned and worn parts pointed out. It is emphasized that all repairs cannot be made by the student, that in many cases the motor must be taken to a motor repair shop for further work.

Broken cords and plugs are repaired or replaced and, on motors which are so built, students are shown how to reverse the motor rotation and how to arrange the wires for operation on 110 or 220 volts. For motors which cannot be put in operation at the clinic students are given instructions on what further steps to take, always mentioning two or more shops to which the motor can be taken for further repair. (This is important, as very few people know where to take motors for repair.) Proper wire size and proper fuse protection and other motor protective devices are explained.

Then, of course, as questions are asked and time permits, other electric uses are discussed and the story of electricity is reviewed, via transmission lines, substations, distribution lines, transformers, and entrance service switches. The use of classroom blackboards makes many explanations easier.

Each clinic, which lasts from two to two and one-half hours, will vary, depending on conditions at the particular school; however, keeping the motor "humming on the farm" is the objective.

AGRICULTURAL SCHOOL STUDENTS get pointers on care and repair of farm motors from the author at a motor clinic conducted by Consumers Power Company. At left is Miss Hester Bradley, Michigan's only woman agricultural instructor

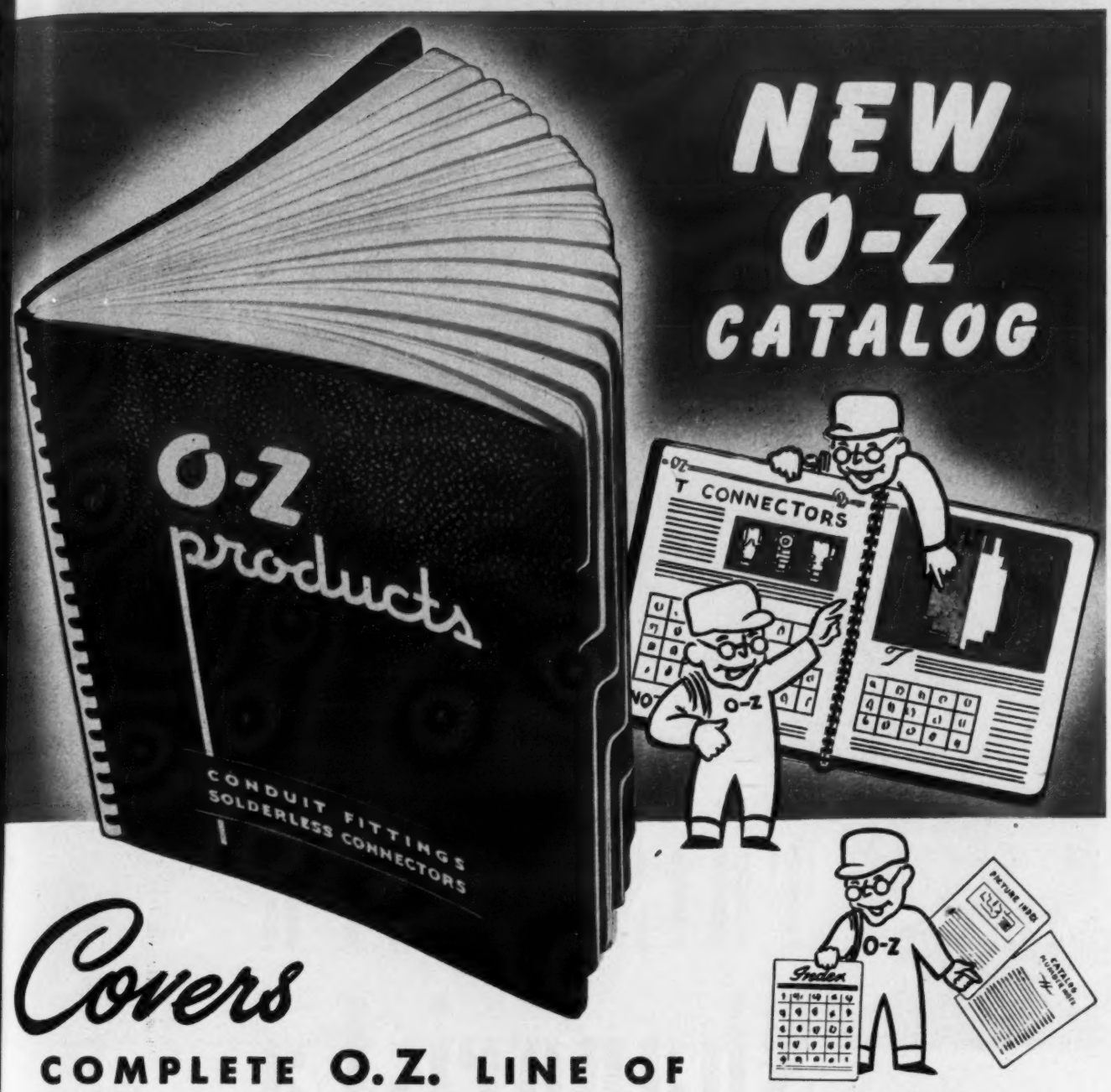
•

R. I. Utility Plans Stable War Service

To protect production in war plants served by its system, the Blackstone Valley Gas & Electric Company, Pawtucket and Woonsocket, R. I., recently selected from its mailing lists about 200 of its larger industrial customers and sent to each customer a series of two letters written and printed on a folder supplied by the Anaconda Wire & Cable Company advertising a plan of preventive maintenance for the consideration of key men in these establishments. This general plan is receiving wider circulation in the industry as a result of the initiation of it by the Anaconda company, which has prepared a "P. M. Manual," with forms, posters and steps to be taken in making surveys of plant conditions with a view toward forestalling failures and interrupting war material output in this critical time. Postcards were furnished with the utility company letters, addressed to the Anaconda company, which in turn advises the utility of their receipt.

H. H. Carpenter, chief industrial service engineer of the Blackstone Valley company, signed the outgoing letters and received 27 names in return. The Anaconda company also supplied the utility with 50 extra copies of the preventive maintenance data book, which the Black-

NEW O-Z CATALOG



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Keep Buying War Bonds

NOTE THESE ADDED FEATURES

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- THREE INDEXES—PICTURE, PRODUCT, CATALOG NUMBER

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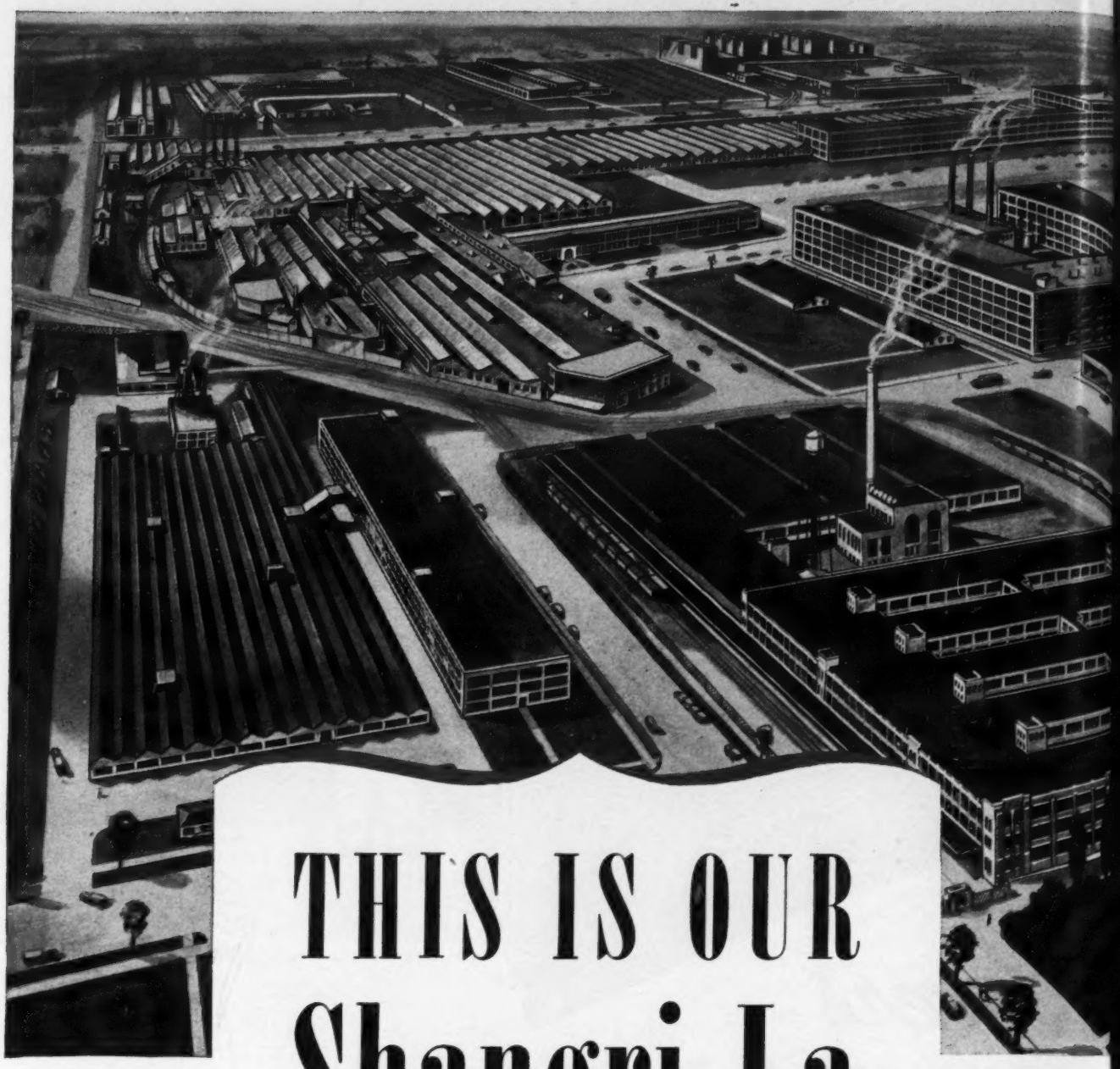

THIS IS OUR Shangri-La

BUT, like the U.S.S. Hornet, from which General Doolittle and his fellow heroes bombed Tokio, it is no fiction. Our "Shangri-La" is a fact deadly to Axis hopes.

For these are the war plants of Nash-Kelvinator!

This is where they come from. Those 2,000 h. p. Pratt & Whitney engines that lift the Navy's mighty Vought *Corsair* fighters seven miles high . . . that speed them seven miles a minute . . . higher, faster, better than the best the Japs have got . . . From here come great, precision-built Hamilton Standard Constant Speed Propellers for Flying Fortress, Lancaster and Mosquito bombers now blasting Hitler's industries and his vision of victory.

And soon from these plants will come the versatile Sikorsky helicopter which we will build in quantity for the Army Air Forces.

No enemy eyes will ever see this group of buildings

Nor, friendly as they are, may yours. For Nash-Kelvinator's factories are strategically distributed throughout the country and are here brought together in one place by the imagination of an artist to visualize for you the magnitude of Nash-Kelvinator's facilities.

When Victory is won there will come from this Shangri-La of industry, with its vast facilities and skills increased by our war work, a finer Kelvinator than ever before. And a sales and profit opportunity that will continue to be the best in the industry!

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Cooperate With Your Industry! Salvage All Inoperative Parts Containing Critical Materials . . . Put Vitally-Needed Scrap Back Into the Scrap TODAY!

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For Getting the Job Done Faster

HOMELITE

Portable Generators

The old Homelite story now has a new twist. Homelite Portable Generators have had plenty of experience in helping to speed emergency repairs . . . and, for that matter, they're still doing it.

But the big job now is to meet the greatest emergency of all time . . . *the war.* Therefore, all new Homelite Generators must go to the Armed Forces . . . to help our Air Force, Tank and Signal Corps do their jobs better and faster.

To meet the requirements of our fighting forces, many improvements have been added to Homelite Portable Generators. Our new models are more powerful, more rugged, and more able to operate under all conditions than ever before. And because of this they'll be far more valuable to you who will get them after the war.

The quality of Homelite Portable Generators — now produced in huge quantities — has earned the high Army-Navy production award. After the war, we'll produce as well for you.

HOMELITE CORPORATION

PORT CHESTER, NEW YORK

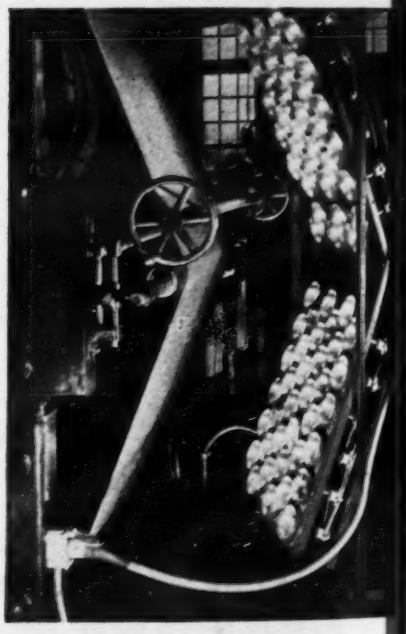
stone Valley distributed to customer who expressed an interest in the pla but failed to return the card. In sub sequent discussions with mill men i the utility's territory interest has bee shown in the program and the pros pects are that many will adopt th plan in whole or in part. The utilit is well pleased with the response re ceived.

•

Infra-red Units Push Up Denim Output

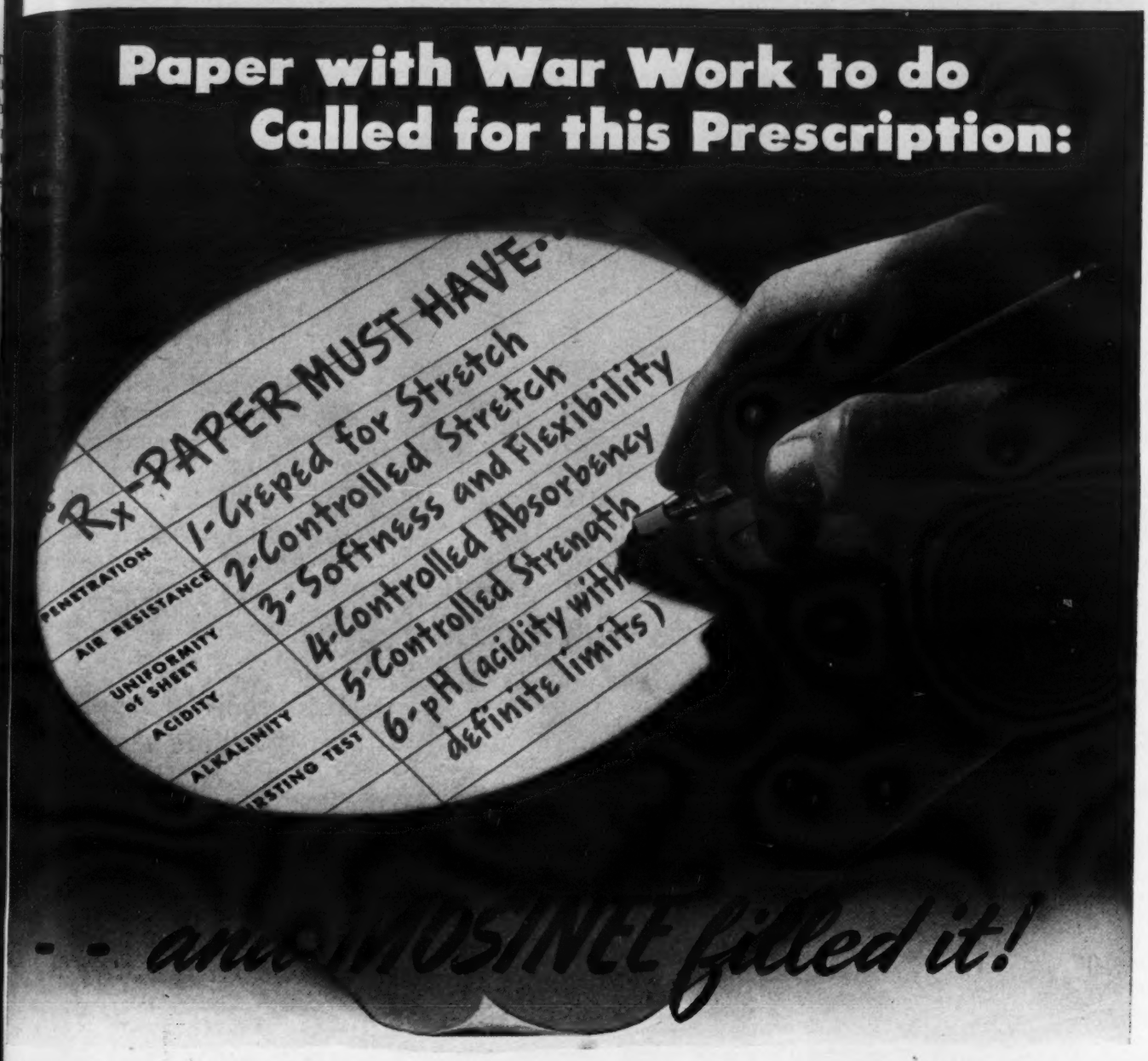
In manufacturing sanforized denim for service men White Brothers, Win chendon Springs, Mass., found essential to increase the speed of dry ing an endless felt belt used in th production process. Sanforizing in volves a thorough soaking of th cloth with steam and water, followe by a drying under heat. The fe belt or blanket is pressed against th wet cloth, which in turn is carrie on a steam heated cylinder. The be becomes soaked with water and mus be dried before the cycle is resume This drying is normally accomplishe by passing the belt over a sma steam-heated cylinder, but the outpu is limited by the thickness of th blanket and the speed of travel.

The White company sought the ad vice of the power engineering sta



TWO BANKS of 250-watt infra-red lamp aggregating 18 kw. in connected loa raised production at a pre-shrinking ma chine from 54 ft. per minute to 117 in plant making overalls and duffle bag for the armed services

Paper with War Work to do Called for this Prescription:



Has the war demand made necessary an adjustment in your paper specifications—perhaps a change in density, absorbency, pliability, moisture-vapor repellency, greaseproofness or dielectric strength?

The Mills of Mosinee, because of flexibility in manufacturing, are able to assist in compounding the prescription for a paper that will give you the technical characteristics you need — thus relieving your processing "headache." Our engineers, at your request and without obligation to you, are available for consultation.

Please address your letter "Attention Dept. B"

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

doesn't mean *neglect* ...even with Bus Duct

So simple, so sturdy, so soundly engineered is Bus Duct that only a minimum of maintenance is needed. Yet that *minimum* is important.

A thorough inspection and routine service once a year are usually enough to keep Bus Duct at top efficiency. But more frequent attention pays, especially where the system may be subjected to moisture, salt-laden air or corrosive fumes.

Here are some points to watch:

Keep hanger bolts and bus bar connections tight.

See that nothing is left in the duct that does not belong there.

Clean out metallic dust and dirt periodically with an air hose.

Watch for insulation abrasions on cables.

Check plugs for loose fuse clips, defective contacts and faulty cable connections.

Maintenance is a real, if unspectacular contribution to the war effort.

Bus Duct can really "take it." Given ordinary, commonsense care, it will keep on delivering power and light under the heaviest loads, at lowest possible maintenance cost.

BUY MORE WAR BONDS • SALVAGE ALL SCRAP METAL

Send for descriptive Bulletin No. 427

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Field Engineering Offices in All Principal Cities

MANUFACTURERS OF Vacu-Break Safety Switches, Saf-ToFuse Panelboards, Circuit Master Breakers, Switchboards, Bus Duct Systems — FOR LIGHT AND POWER.

of the New England Power System a to the possibilities of speeding u production by using infra-red unit to supplement the steam-heatin equipment. Tests with experimenta lamp banks loaned by the utility t the White plant led to the installa tion of the infra-red equipment il lustrated, 72 250-watt units bein installed on the angle-iron frame i sections of 36 each, the units bein nested as closely as possible in stag gered rows of three lamps each. I operation the lamps are moved u to within 6 to 8 in. of the blanket The lamps are automatically cut of in case the belt stops, in order t prevent injury to the belt. In this in stallation production has increase from 18 to 39 yd. per minute and th useful life of the belt (which cost about $1,000) has been lengthene 10 percent, with no additional floo space or attendance.

•

Home-made Brooder for Wartime Use

Because wartime limitations mak manufactured electric brooding equip ment difficult to secure, the Univer sity of California Agricultural Engi neering Division has prepared speci fications for an emergency home made unit.

A brooder box 3 ft. square an heated with three 75-watt lamps ha been designed for 75 to 100 chicks For 25 to 50 chicks the box should b 2 ft. square with two 75-watt lamps if more than 100 chicks are to b brooded it is suggested that two o more brooders be used.

Lamps are placed at the top of th box in porcelain receptacles on 12-in centers. No. 18 rubber-covered wir is run through the wood in 3-in. porce lain tubes and is held on the exterio by a porcelain cleat. Approximately 7 ft. of No. 18 (or larger) insulate wire are required for the 100-chic brooder. Tin reflectors, 6 or 7 in across, can be made from food cans

Top and sides of the brooder bo can be made of 1-in. boarding o plywood. Where the top is not tigh it is recommended that ½-in. celotex firtex or similar insulating materia be fitted beneath the top boards.

A curtain is made of strips of cloth canvas or oilcloth, approximately 4 in. wide. The curtain should b tacked to the inside of the box i

Demand for FRIGIDAIRE Wartime Suggestions booklet passes the 5 million mark!

Buy War Bonds for Victory
Save food, flavor, money too!
FRIGIDAIRE
gives these timely suggestions to help you fight food waste
Before the war only your pocketbook suffered if you tossed away a withered vegetable, a dry chop, or a dish of leftover cooked food. But now food waste also hurts the nation's war effort and robs the family table!
No one wastes food deliberately. But losses do occur! Sometimes through improper food storage. Or failure to use every drop and crumb. Knowing the best ways to use your refrigerator helps you minimize waste, save precious points. Check the food-saving ideas on this page. You're an unusual woman if you know them all!
Fresh Meat should not be frozen, keeps best in meat or defrosting tray. Cover lightly with waxed paper. Leave ends open for free air circulation. Do not cut or chop meat until cooking time—keeps better in the piece. Wrap and freeze ground and variety meats if not to be used day of purchase.
Eggs left at room temperature for 3 days lose as much freshness as in 2 months in refrigerator! Never wash eggs before storing, it destroys a protective film that guards freshness. Cool milk and egg dishes like custards in pan of ice water, then cover and refrigerate until serving time.
Milk should never be left in sunlight or at room temperature. Refrigerate immediately, continuously. Never pour milk or cream back in bottle. CHEESE should be wrapped in waxed paper to prevent drying. Keep soft types covered, use promptly. BUTTER needs tight cover to protect flavor.
Soft Fruits and Berries should be sorted, spread out on shallow pan or plate, and refrigerated. To guard against mold, do not cover. Handle carefully, any bruise in skin helps hasten spoilage. As a further precaution against mold, never wash berries until just before using.
Fresh Vegetables lose their vitamin content rapidly at room temperature. Wash and drain them immediately after marketing and store in covered container in refrigerator. Pile them loosely to prevent bruising, quick spoiling. Save usable trimmed outer leaves for use in soups.
Melons, when ripe, need refrigeration. Until then, keep them dry to prevent mold—at room temperature to improve taste and texture. Handle gently to avoid bruises. When chilling, cover cut ends with waxed paper. Wrap cantaloupes well to guard other foods from strong odors.
SAVE ends of cheese once used. Grate and store in covered jars for use in casserole dishes.
SAVE fat drippings for home use or for salvage. Refrigerate bacon grease or drippings.
SAVE the vitamin values of leftover vegetables by using them uncooked in salads.
SAVE uncooked egg whites in tightly covered jar for use in meringues, frostings, etc.
SAVE unused vegetable juices for soups, etc.—fruit juices and syrups for desserts, drinks.
SAVE the good in leftover cooked meat by storing in a covered dish. Prevents drying.
FREE! Get WARTIME SUGGESTIONS from your Frigidaire Dealer
This valuable 36-page booklet tells many other ways to combat food waste, gives many timely tips on refrigerator care. Get your free copy now. Look for your Dealer's Frigidaire sign or find his address under "Refrigerators" in Classified Telephone Directory. Or write Frigidaire, 28b Taylor St., Dayton, Ohio.
FRIGIDAIRE REFRIGERATORS
When you need refrigerator help, call an approved Frigidaire Service Dealer listed under "Refrigerators" in your classified telephone directory.
PRODUCTS OF GENERAL MOTORS "FOR SERVICE CALL"
FRIGIDAIRE Division of GENERAL MOTORS
Peacetime Builders of Home Appliances, Commercial Refrigeration, Air Conditioners
Next Month: "Quick'n Easy Meals"

"Public anxious for this kind of information"

"600 requests from one radio announcement"

"Entire supply of booklets exhausted in two days"

"Gave away 1300 booklets Saturday"

"Building more genuine customer appreciation than anything we have had in 18 years"

THESE typical field reports give you an idea of the extraordinary dealer and public interest in the Frigidaire campaign. The entire program is a tremendous success!

Dealers are enthusiastic as they witness public reaction to national advertising and local promotions built around the WARTIME SUGGESTIONS Booklet. All types of dealers from all parts of the country are writing in to tell how they are capitalizing on this real opportunity to build good will in their communities by rendering a genuinely helpful service to present and potential customers.

To date public and dealer demands for WARTIME SUGGESTIONS Booklets have exceeded 5 million copies, and this figure is steadily growing as an ever increasing number of dealer activities get under way.

Here's a campaign that speaks the dealer's language

. . . for it talks about refrigeration — the dealer's business. The above ad, 5th in a series, will appear in full color during July and August in Life, Ladies' Home Journal, Woman's Home Companion, Good Housekeeping, and McCall's, and in 2 colors in Better Homes & Gardens, American Home, True Story, and Farm Journal and Farmer's Wife.

For Excellence — ARMY (E) NAVY — *in War Production*

FRIGIDAIRE Division of GENERAL MOTORS

Peacetime builders of Home Appliances, Commercial Refrigeration, Air Conditioners

FIRE ....and the nearest Fire Department is 1,500 miles away!

Maybe the fire strikes a tropical air base. Or perhaps it happens in an arctic outpost of our armed forces. Wherever those fires flare up... whenever they do...they are quickly and decisively conquered when duGas dry chemical fire-fighting equipment is used.

On both fighting fronts and production fronts fire takes a fast knock-out when duGas gets to work. For duGas dry chemical releases huge volumes of fire-smothering gases that stop combustion *fast.* And duGas dry chemical is always ready for action...no matter how torrid or frigid the climate.

Right now, our full-time job is manufacturing duGas fire-fighting equipment for our armed forces and America's vital war industries. After Victory, duGas fire-fighting equipment will again be available to all.

duGas

MODEL 30-T HAND EXTINGUISHER

MODEL 150 WHEELED EXTINGUISHER

FREE: New chart showing characteristics of all types of approved hand fire extinguishers. Write for copy today.

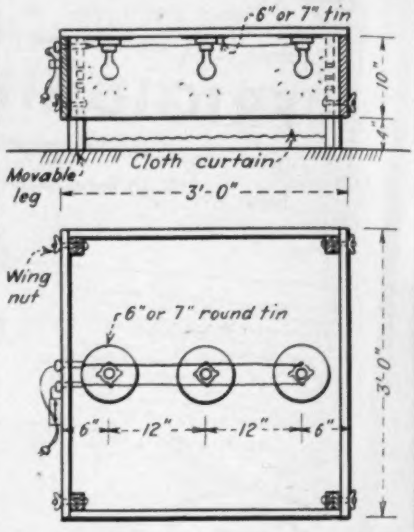
DUGAS ENGINEERING CORPORATION, MARINETTE, WISCONSIN

OWNED AND OPERATED BY ANSUL CHEMICAL COMPANY

such a way as to insure an opening of about 1½ in. at the bottom.

Movable 1 x 2-in. legs bolted to the permanent legs allow for increasing the height of the box as the chicks grow. Holes should be bored in the movable legs to provide for raising the brooder 1 in. at a time. It is recommended that the brooder be raised 1 in. every two weeks for the first six weeks.

As the chicks increase in size and age and as weather varies heat can be reduced by turning out one lamp, or by replacing the three lamps with units of smaller wattage. Under nor-



CONSTRUCTION DETAIL of home-made brooder

mal conditions, it is recommended that the 75-watt lamps be replaced by 50-watt lamps when the chicks are two weeks old and that 25-watt lamps be used when the chicks are four weeks old. Depending upon weather and temperature conditions, it is pointed out that it may be possible to turn off one lamp after six weeks and to discontinue all artificial heat after seven or eight weeks.

In issuing the instructions the university suggests that before using this brooder, or any other artificially heated brooder, fire insurance policies should be checked for clauses pertaining to such use.

It also points out that a brooder of this type will be satisfactory only if used in a building which will protect the chicks against rain, wind and other adverse weather conditions. If the brooder is placed in a large space, it is suggested that, for the first two or three days, a circular guard fence be used to confine the chicks within 2 ft. of the brooder.

ROCKBESTOS A.V.C. RESISTS MOISTURE

Rockbestos Permanent Insulation Insures Long-Lived Performance

Rockbestos A.V.C. Power Cable illustrated*, and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction.

1. The conductor is perfectly and permanently centered in helically applied insulation that stays put and will not migrate or flow.

2. Felted asbestos insulation that withstands conductor-heating overloads and won't burn even when exposed to copper-melting arcs.

3. Lubricated varnished cambric for high dielectric strength and high moisture resistance, protected from heat, flame and oxidation by two felted asbestos walls.

4. Outer felted asbestos wall which serves as a heat-barrier against high ambient temperature.

5. A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

**One of 122 different wires and cables developed for severe operating conditions.*

Dampness, humidity and moisture raises hell with wires in electrical circuits that run around steel mill furnaces, finishing stands, soaking pits, boilers, steam tunnels, etc. It rots the insulation, causes shorts, and often ties up important production through wire-failure. You can guard your circuits against this hazard by wiring with Rockbestos A.V.C.—the wire that has ample moisture resistance and, in addition, provides heatproof and fireproof protection. Designed for high temperature locations, *permanently insulated* Rockbestos A.V.C. resists heat, flame, moisture, oil, grease and corrosive fumes. It won't bake brittle, crack, bloom, rot or swell. Prevent wire-failure in your "hot" locations with Rockbestos A.V.C.

When inquiring or ordering, please furnish CMP certification and allotment number with delivery month. For recommendations write nearest branch office or: Rockbestos Products Corporation, 902 Nicoll St., New Haven, Conn.

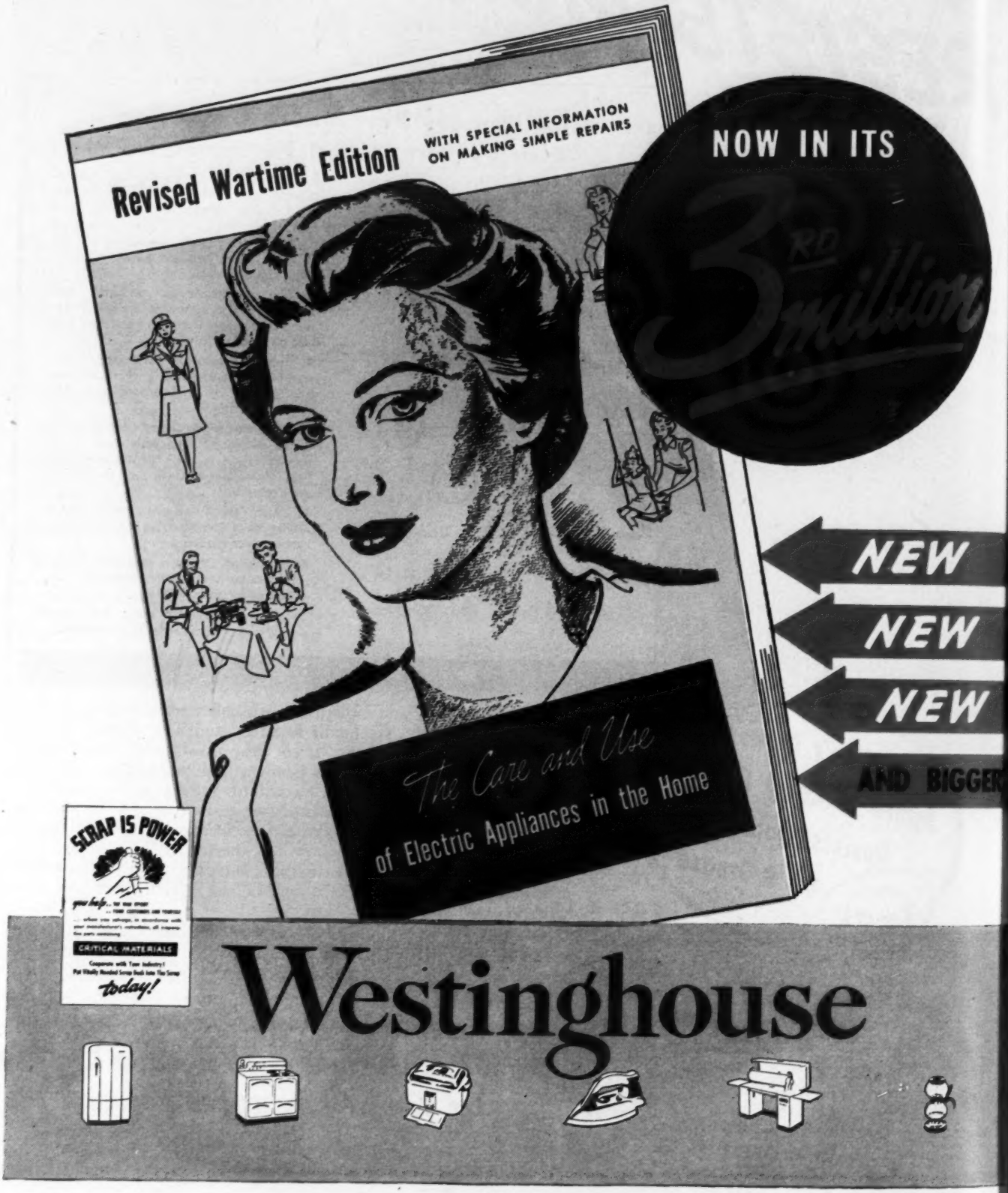
ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

FOR VICTORY ★ Invest in United States War Bonds ★

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

COMPLETELY REVISED



and Ready!

Here's What The New Wartime Edition of the "Care and Use" Book will do for you

1 IT WILL SHARPLY REDUCE NEEDLESS SERVICE CALLS

It tells folks what to check before frantically calling a serviceman, how to make *minor* repairs themselves and, so far as is possible, how to diagnose common complaints so you'll know what tools and parts to bring on the first call. Furthermore, it urges people to bring small appliances right to your store instead of phoning for a pickup. This new, 52-page book, will not only build a lot of good will for you, but should also save you service headaches. At the price of a penny apiece, which is far less than the cost, you can afford to distribute it widely.

2 IT WILL DIRECT PEOPLE TO YOU FOR DEPENDABLE CONSERVICE

This book is your one best bet to make your store headquarters for Conservice in your community. Tells your customers and prospects how to get the best use out of their appliances . . . and how to prevent breakdowns. When they *do* need expert professional service—they'll just naturally turn to you. Promote this book to build good will and stimulate store traffic. A new "Care and Use" Book Ad Guide has been especially prepared to help you build a Conservice activity around this book. Your Westinghouse Distributor will gladly give you a copy.

Fix-it-yourself Section

18 pages of detailed, easy-to-follow advice on how to make minor adjustments and repairs on 14 popular appliances. Plugs, cords and lighting are also covered.

Wartime Conservation Suggestions

All through the book there's a wealth of tips on how to use each appliance so it will do more . . . and last longer. All the information is thoroughly indexed.

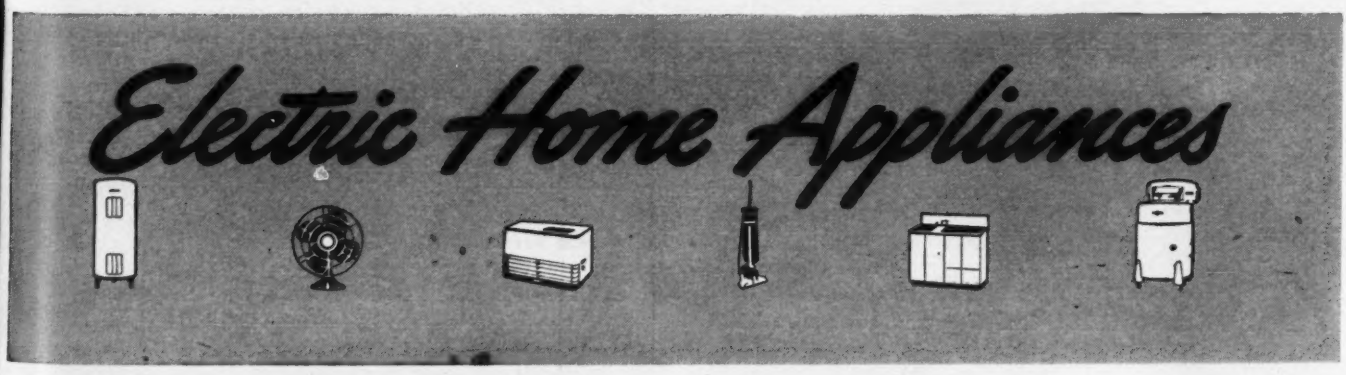
Timesaving Homemaking Hints

Among thousands of women this was one of the most popular features of the first "Care and Use" Book. So, for good measure, we've added a lot more of them.

THAN EVER . . . 52 Pages

Actually 1/3 larger than original edition. Printed in two colors with 97 illustrations, it is jam-packed with the kind of information on appliances that women crave.

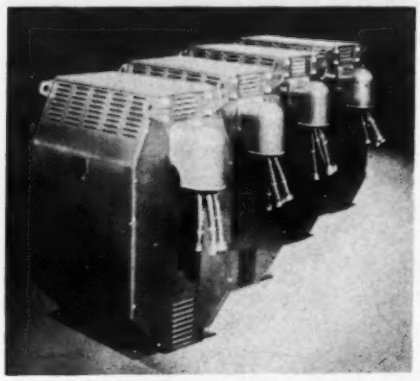
DO IT NOW FOR LATER. **By placing this book in the hands of customers and prospects you'll be making a real contribution to your own postwar program.**



NEW EQUIPMENT

Transformers

A new series of dry-type natural-draft transformers for indoor use has a two-legged core with a high-voltage coil and a low-voltage coil on each leg. Core is



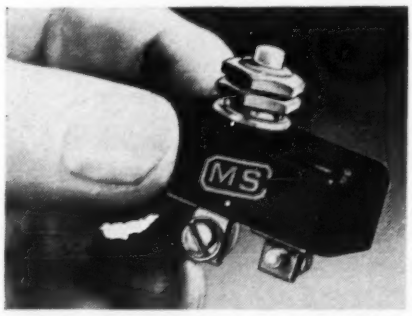
Type "D" dry-type transformer; ratings up to 100 kva., 600 volts. **General Electric Co.**, Schenectady, N. Y.

clamped at top and bottom, the latter serving as mounting feet. Ventilation is said to be more effective by slanting louvered side plates removable for coil inspection. Large portion of copper is outside of core providing for maximum cooling coils. Units can be mounted against wall or close to other units, it is claimed, with little or no effect on temperature rise.

•

Switch

An addition to the company's line is a tiny switch available with and without an inclosing case. When used without the case, actuating movement can be supplied anywhere over a large portion of the upper spring, it is claimed. With the Bakelite case a convenient stem mounting is provided. Contacts are silver and the wide contact gap is said to be valuable on d.c. loads.



"Peanut" switch; contact gaps up to 0.085 in. **Micro Switch Corp.**, Freeport, Ill.

Connector

Type "DP-B" connector; eight silver-plated contacts, two 30 amp. and six 15 amp. **Cannon Electric Development Co.**, 3209 Humboldt St., Los Angeles, Calif.

Rectangular rack type connector has die-cast aluminum alloy shell. Insert insulation is made of molded phenolic having metal contacts and two coaxial contacts of the same materiadl, with isolantite insulators. Shell has four mounting holes for No. 8 flat-head machine screws. Unit is said to be adapted to applications where both plug and receptacle must be fixed permanently in their respective units of equipment.

•

Degreasing Tank

Dipping tank has electric heating element located on the bottom of the tank, completely submerged. Average heating time from a cold start to boiling point is said to be 1¼ hours. Thermostatic control

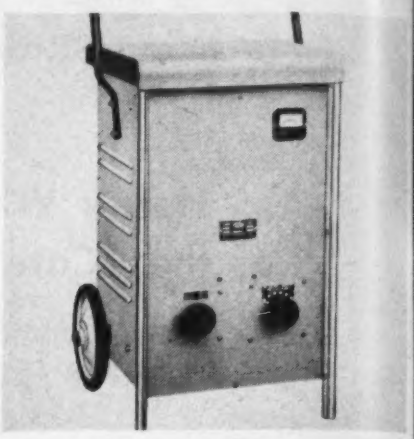
"Dipmaster, Jr.," portable, insulated dipping tank; 15 gal. max. capacity; 110 or 220 volts, a.c. or d.c. **Aeroil Burner Co., Inc.**, Park Ave. at 57th St., West New York, N. Y.

automatically maintains any temperature between 100-550 deg. F. and steel tank is insulated all around the inner shell. Electric heating element may be removed when cold solutions are used or when tank is to be cleaned.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Rectifiers

Electrical rectifier incorporates dry-disk magnesium-copper-sulphide type of rectifying element. Heavy-duty type units are claimed to stand an intermittent overload of 100 percent for three minutes. Output



"Rectodyne" rectifiers; capacities up to 4,000 watts; 6, 12, 24, 36 and 48 volts d.c.; operate on single- and three-phase, 115-, 230- and 460-volt circuits. **McColpin-Christie Corp., Ltd.**, 4920 South Figueroa St., Los Angeles, 37, Calif.

is regulated by a rotary tap switch in primary circuit. Series-parallel switch is provided for doubling d.c. ampere capacity at half voltage. Ventilation is provided by motor driven fan. Stationary and portable units are available for tests floors and air fields.

•

Cleaning Machine

"The General" precision cleaner. **L. & R. Manufacturing Co.**, 54 Clinton St., Newark, N. J.

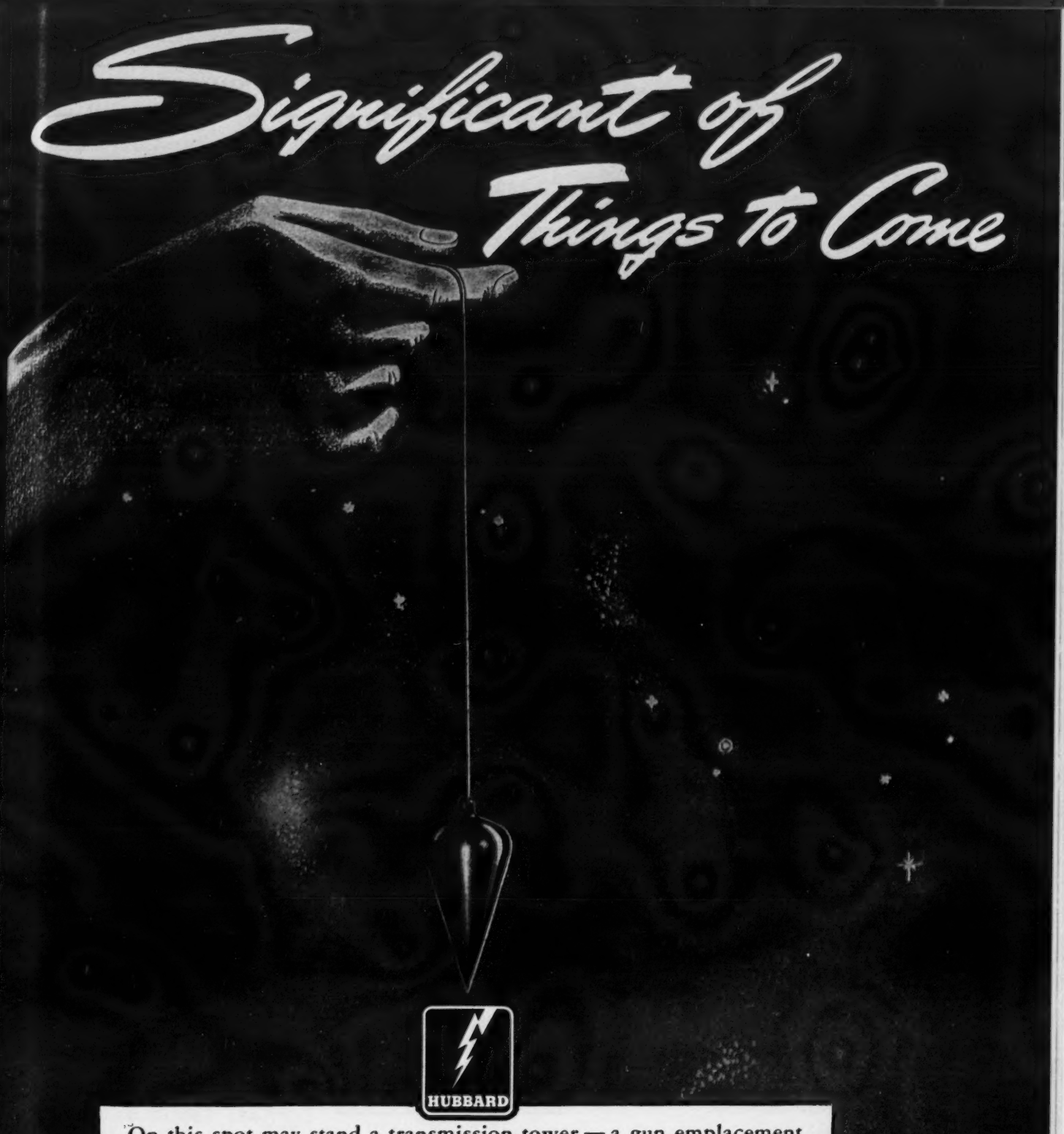
New addition to the company's line is a self-contained unit for cleaning operations in the production of electronic tubes. The cleaner is operated by an air-cooled fractional-horsepower motor, equipped with a work basket 2¼ in. deep by 3¼ in. I.D. plus nesting basket subdivided into three compartments, and variable action of the basket in solutions. By snapping on the thermostatic switch, a surging centrifugal motion of the basket is produced with varying speeds.

•

Terminal Block

Multiple terminal block has feed-through terminals mounted in bakelite and permanently held in a metal strip. It is suitable for electronic and other electrical subpanel and chassis construction. No. 8 screws are used on each side of the terminal units for securing connections. Two mounting holes at each end of the terminal base take No. 8 machine screws.

"Feed-Thru" terminal block; capacity, number of terminal units as needed; circuits up to 300 volts, 20 amp.; ⅝-in. center to center of terminal units. **Curtis Developments & Manufacturing Co.**, 1 North Crawford Ave., Chicago, Ill.



HUBBARD

On this spot may stand a transmission tower — a gun emplacement or new factory. It is the preliminary step to events of the future. It is symbolic of the state in which many of your suppliers find themselves at this time; going over the top on war production but with an eye cocked on the future.

Most of the men and machines of the three Hubbard factories have gone into vital war production, but the plumb bob is swinging, settling down to mark a spot for future development. New designs of Pole Line Hardware are coming. New equipment is being readied to test new principles.

Big things are "in the making". Watch for them, and in the meantime; "Maintain that load on Hubbard Hardware."

HUBBARD AND COMPANY

PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

1913 2043 ENTERING OUR SECOND CENTURY OF SERVICE

Today more than ever...

ORANGEBURG FIBRE CONDUIT

Gets the Call for Cable Protection!

• Engineers on wartime construction jobs are specifying Orangeburg Fibre Conduit more and more for protection of cables carrying vital power, light, fire, telephone, and signal services in war plants, power plants, shipyards, airports, cantonments, and naval bases.

• There are many reasons for this increasing preference. By using Orangeburg Conduit instead of metal, critical materials are conserved. Orangeburg provides *complete* cable protection *underground* or *underfloor*—yet costs less than metal conduit. Does not corrode; joints and conduit are water-tight. The surface of Orangeburg Fibre Conduit will not corrode cable sheath and long pulls are possible with minimum friction. It is light in weight—assembles and installs faster—saving time and cutting cost of installation.

• Cable repairs and extensions are simplified, too. New cable is pulled in easily and economically without damage and without ripping up ground or construction. Write for further information today.

ORANGEBURG STANDARD CONDUIT
for installation with concrete encasement

ORANGEBURG NOCRETE CONDUIT
for installation without concrete encasement

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ORANGEBURG

WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.

TECHNICAL LITERATURE

STANDARDS LIST—List of American Standards includes more than 600 standards, 9 of which represent new and revised standards approved since last (Aug. 1942) issue. In addition to subject and alphabetical listings, a section is devoted to American War Standards. Requests for copy should be made in writing and addressed to American Standards Association, 29 West 39th St., New York, N. Y.

CORES—For designs of electromagnetic and radio apparatus a 12-page booklet provides performance curves which compare Hipersil and ordinary silicon steels, charts of recommended Hipersil applications, and diagrams of type "C" core assembly. Copy of booklet, B-3223, "Hipersil Cores," may be secured from Department 7-N-20, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

REFRIGERATION CONDENSING UNITS—Commercial Standard (Emergency), CS (E) 107-43, "Commercial Electric-Refrigeration Condensing Units," has been developed to establish minimum standard specifications and methods of test for the units (all applications). It is for the guidance of manufacturers, distributors, installers, contractors, and users, and was accepted by the trade as its standard of practice for new production beginning May 15, 1943. Copy of the National Bureau of Standards publication may be obtained from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.; price 10 cents each.

"DRI-FILM" is the title of a 14-page booklet describing and giving data on a new compound Dri-Film for water-repellent treatment of ceramic bodies used principally in radio equipment. Publication GEA-3648 may be obtained from Electronics Department, General Electric Co., Schenectady, N. Y.

CABLE—"The Oilostatic Transmission System—Its History and Some of Its Newer Applications" is a 16-page publication containing some of the preliminary test results, a brief discussion on mechanical ruggedness of cable pipe line construction, and a description of adaptation of Oilostatic for generator leads; also a brief history of installations made in past 10 years. Copy of Research Laboratory Publication OC-102 is obtainable from the Okonite-Callendar Cable Co., Inc., Passaic, N. J.

TIMELY TIPS on Wartime Care and Maintenance of Electric Farm Pumps and Water Systems" is a 16-page owner's manual written in non-technical language, having sections on motors, belts, lubrication, priming, pressure tanks, air volume, controls, pressure switches and stuffing boxes. The manual has been published by the Electric Water Systems Council. Owners may obtain copies through dealers, and dealers should apply for copies to distributors of electric farm water systems.

INDIUM—New annotated "1941-1942 Supplement to the Bibliography of Indium" contains references to occurrence and extraction of the element, electrical, chemical and physical properties, qualitative and quantitative analysis, alloys, and miscellaneous information. Copy available from the Indium Corporation of America, 60 East 42d St., New York, N. Y.

FROM THE *business* END OF THE "TOMMY" GUN...

...comes the research engineering skill to speed wartime manufacture and solve postwar production problems

GENERAL Electronic INDUSTRIES

A Division of Auto-Ordnance Corporation

GREENWICH • STAMFORD • BRIDGEPORT • NEW YORK

● Our fighting forces needed Thompson Submachine Guns . . . *thousands . . . fast!* Auto-Ordnance Corporation has produced them *on time!*

The arsenal of freedom required tools of war production. Auto-Ordnance's Thompson Tool Division helped—is helping—to supply them!

The research engineering skill that has made good in the business of developing and producing guns, tools, vacuum tubes of both standard and special types, and other such weapons of Victory has achieved even greater, though secret, accomplishments in the fields of *Electronics, Hydraulics* and *Electromechanics!*

Many industrial leaders are already planning to "get the jump" on competitors after the war, with electronic devices to reduce production time, cut costs and improve precision manufacture. Perhaps we can make a notable contribution to your planning. *Write to Engineering Department, General Electronic Industries 342 West Putnam Avenue, Greenwich, Connecticut.*

Army-Navy "E" awarded to Auto-Ordnance Corporation for excellence in production of "Tommy" Guns.

●

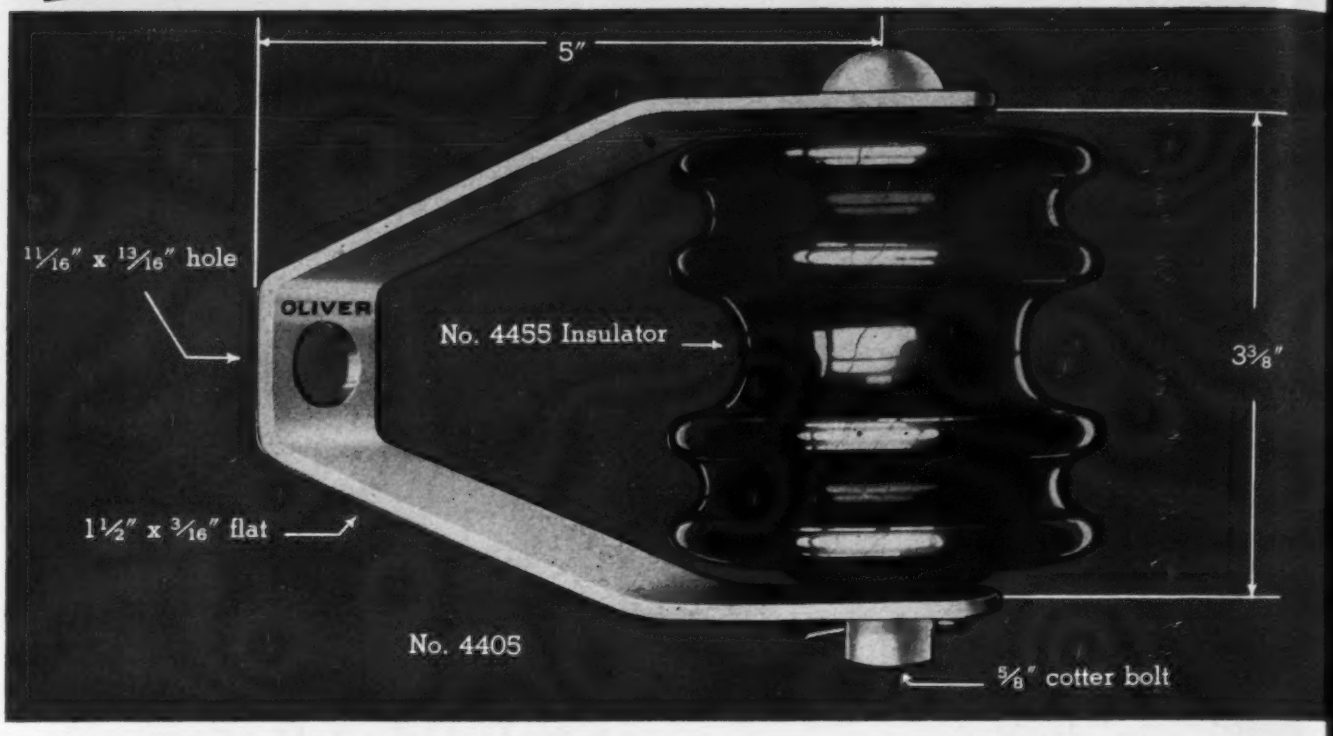
PRODUCTS MANUFACTURED INCLUDE ELECTRONIC CONTROLS • VACUUM TUBES
HYDRAULIC SERVOS • ELECTROMECHANICAL DEVICES

. . . from the COMPLETE LINE OF

OLIVER

POLE LINE MATERIALS

CLEVISES

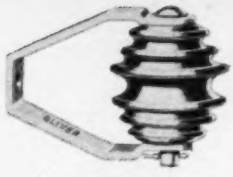


Of all the Oliver products used by linemen, there is probably no group of items more generally useful and necessary than Clevises. For dead-ending, for service take-off, for corner installations, for breaking wires—Oliver Clevises, in a score of types and sizes are designed to solve all line construction problems.

As indicated by the illustrations, Oliver Clevises are offered with a variety of designs for rigid or flexible mounting, and with insulators specially designed for the type of service desired. All steel parts are of mild open-hearth steel hot-dip galvanized. Insulators are of brown glazed porcelain, wet process porcelain being used for dead-ending primary lines and dry process for secondary lines. White-glazed insulators for designating neutral circuits can be supplied also.

For attaching clevises to crossarms, poles, buildings, Oliver makes several types of devices that speed erection and assure dependable mounting.

Our engineers will be glad to show you how Oliver Clevises are being widely used in a variety of ways.



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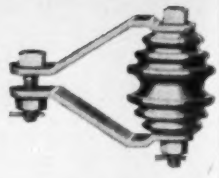

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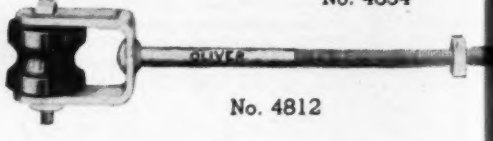

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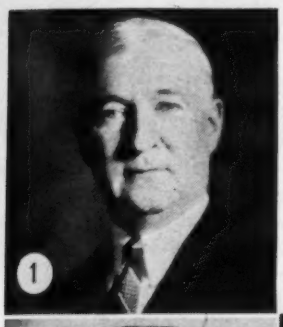
PITTSBURGH, PENNSYLVANIA

NEWS ABOUT PEOPLE

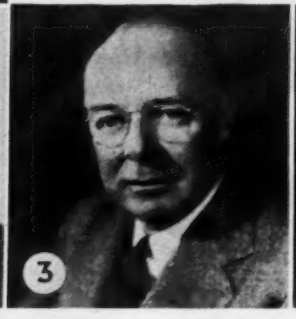
New Officers Elected by Jefferson Electric

At a recent meeting of the board of directors of the Jefferson Electric Co., Bellwood, Ill., new officers were elected. John A. Bennan, formerly president, became chairman of the board; J. C. Daley, formerly vice-president and treasurer, was made president and treasurer and A. E. Tregenza, formerly vice-president and general sales manager, was named executive vice-president. James M. Bennan was made vice-president and general sales manager, A. A. Flick, Jr., vice-president in charge of manufacturing and R. A. Hoagland vice-president in charge of war contracts.



1 J. A. Bennan

2 J. C. Daley



3 A. G. Tregenza

4 J. M. Bennan

Along with these changes in officers, four executive engineers have been appointed. E. G. Goddard was placed in charge of commercial products, R. J. Horstmann in charge of radio and electronic products, L. Mauerer in charge of design and development and E. W. Rickmeyer in charge of mechanical products. E. J. Banigan was named director of purchases and H. F. Tobler personnel director.

Jefferson Electric Co. was founded in 1915 by John A. Bennan and J. C. Daley and was located originally in Chicago. In 1932 the company moved into its newly constructed plant in Bellwood.

•

Long to Take Office as U.G.I. Head in Fall

Walter E. Long, who was elected president of the United Gas Improvement Co. at the recent meeting of the board of directors (ELECTRICAL WORLD, June 19, page 20), will take office as chief executive on September 1.

Mr. Long has been associated with the utility industry since 1904, when he entered the employ of the Philadelphia Electric Co. He was advanced to the position of controller and later was elected a vice-president of that company. In 1928, when U.G.I. acquired control of Philadelphia Electric, Mr. Long became a vice-president of U.G.I., the office he has held since that time. He is also a director and officer of U.G.I. subsidiary companies.

For many years Mr. Long was active in the Pennsylvania branch of the old National Electric Light Association and he is a past-president of the Pennsylvania Electric Association.

•

▶H. S. OSBORNE, formerly assistant chief engineer, operations and engineering department, American Telephone & Telegraph Co., New York, N. Y., has been appointed chief engineer of that department. Mr. Osborne is currently serving as president of the American Institute of Electrical Engineers.

Chicago Utility Combines Lighting, Power Sales

George H. Jones, veteran manager of power sales for Commonwealth Edison Co., Chicago, retired on June 30 after nearly 46 years of active service in the utility industry. Mr. Jones was honored by his associates at a farewell luncheon in the University Club.

The Commonwealth Edison power sales department, formerly headed by Mr. Jones, will be consolidated with the lighting sales department. Ralph G. Raymond, now manager of lighting sales, will head the combined organization, to be known as the electricity sales department, the company has announced. F. W. Boldenweck, at present assistant manager of power sales, will become assistant manager of the new department.

G. H. Jones

Five divisions, commercial sales, industrial sales, sales promotion, home service and general office, are included in the combined department as now organized. The commercial sales divi-

R. G. Raymond

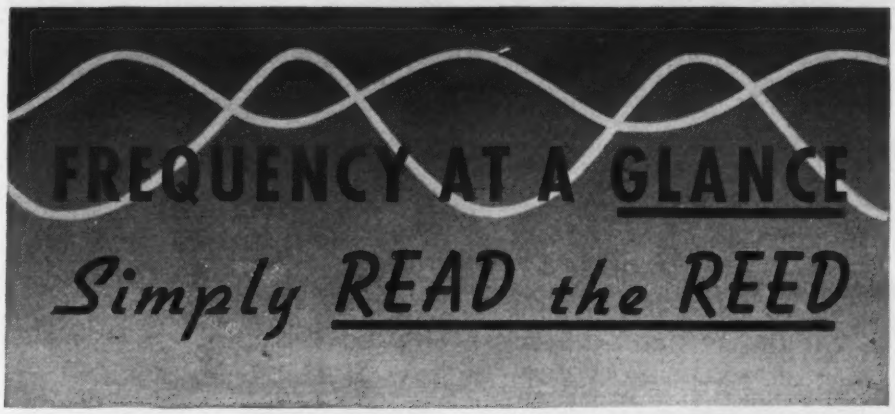


Figure 1. Here, the vibrating reed shows a frequency of 60 cycles per second. It is easy to read because the *white* enamelled flag on the 60 cy. reed is vibrating through *three times* its normal length — against a black background.

Figure 2. This same meter now shows a frequency of 60.5 cycles. The 60.5 cy. reed shows maximum vibration, bracketed by the 60 cy. and 61 cy. reeds vibrating equally but to a lesser extent, directing the eye to the 60.5 cy. reed.

Figure 3. Now, both 60.5 cy. and 61 cy. reeds are vibrating equally, each but slightly less than maximum. True frequency is correctly read as 60.75 cycles per second. These examples show how *half-cycle increments* give easy, accurate readings.

Besides being easy to read—accurately—J-B-T Vibrating Reed Frequency Meters are simple in design, with fewer parts, permanently accurate, requiring no adjustment while in service even under adverse vibration conditions. They are low in power consumption and are not affected by wave form, normal temperature change, or external magnetic fields.

J-B-T Vibrating Reed Frequency Meters are available in full range of frequencies, voltages, reed groupings and case sizes. For prompt delivery — for meters to meet the new A.S.A. specifications — for the *RIGHT* meter to fit your specifications and needs—consult J-B-T.

Figure 1

Figure 2

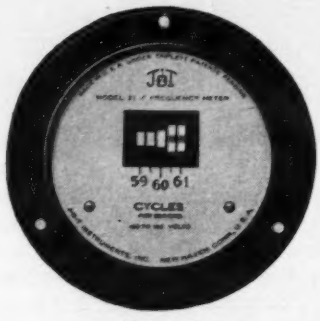


Figure 3

(Manufactured under Triplett Patents and/or Patents Pending)

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sion, under the supervision of Paul F Kauffman, will handle service to retai commercial and industrial customer having connected loads of not mor than 25 kw. The industrial sales divi sion will handle service for large ligh and power users. John Burkhardt an Frank H. White will continue as dis trict sales supervisors in charge o work in this division.

The sales promotion division wil supply staff engineering assistance fo the two sales divisions, such as techni cal reports when necessary in connec tion with the isolated plant conversion wiring, air conditioning, commercia refrigeration and heating appliances It will prepare and present technica training programs. Representatives o this division will also act as engineering counselors for customers.

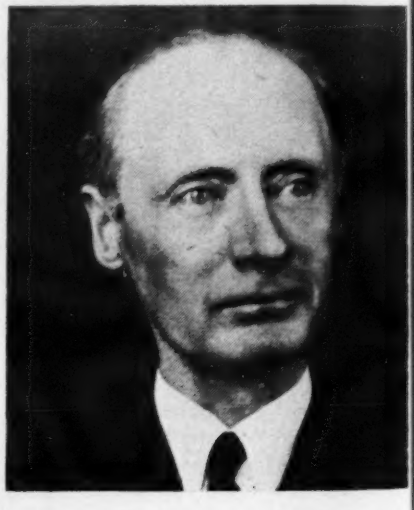
Activities of the home service divi sion will continue under the direction of supervisor Knight C. Porter. Frank M. Geddes, former power sales analyst will head the new general office division as chief clerk.

•

Cleveland Utility Names North Sales Manager

Cleveland Electric Illuminating Co. has announced the retirement of H. C. Gillie, vice-president in charge of sales, and the appointment of J. E. North as sales manager.

Mr. Gillie's retirement followed 36 years' service with the Cleveland utility.



H. C. Gillie

He was graduated from the Case School of Applied Science in 1905 and became a sales engineer with the company two years later. During his long service with the company Mr. Gillie has contributed to the industrial development of the Greater Cleveland district and to the transition by industries in that district from use of individual power

OUR TRADE MARK

What do you think of it? A simple and direct symbol to know us by! Back of it stands over 13 years of experience in inventing, designing, manufacturing, and distributing electrical connectors for the Public Utility Industry. Ahead of it is a future as bright as we can build by the same Sheldon Service Organization that has won us the respect of Utility Engineers and Purchasing Agents in most of the leading Systems across the country. We want you to look upon this new trade mark as a promise for service. Service to us means that when you specify "Sheldon Service", you will get the best electrical connectors it is possible to make, and you will get them on *the* day they were promised to be delivered. Our trade mark will henceforth be stamped on every piece of equipment we manufacture.

We shall be happy to have a line from you on how you like it.

H. C. Sheldon

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HERE'S THE SHELDON SERVICE CORPORATION'S POLICY—

1. To make connectors whose performance excels the actual requirements of the job—a factor of safety and dependability of important advantage to the user.

2. To make no product which we cannot control at every step of its manufacture.

3. To establish prices on one basis and one basis alone—namely, cost plus a reasonable profit.

4. To pass all possible savings on to users . . . to make price changes only when circumstances affecting manufacture warrant them, to quote only **BELIEVABLE ROCK BOTTOM PRICES.**

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1. Originators of the "friction-free" and "snub-grip" principles in Splitbolts.

2. Inventors of Nobolt high-pressure internal-expansion tubular bus connectors . . . the first major improvement in tubular connectors in ten years.

3. Designers of many power connectors which were actually correctly engineered for the first time.

4. Improvers of many Underground compression type connectors which have greatly reduced the costs for users.

5. Made, "Service", to really mean something to Electrical Connector users.

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To assist in making equipment last longer—give better service—we have prepared a booklet on the care of tools and suggestions for their safe use. It is filled with information on the kind of equipment that linemen and electricians use daily. A copy will be sent to anyone interested without charge. Mail the coupon below.

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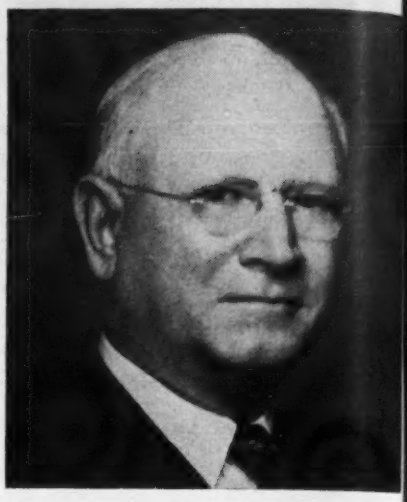
plants to use of power service supplied by the company. He is well known among industrialists and in the sales engineering field. Mr. Gillie is preparing to move to Los Angeles.

Mr. North joined the company in 1919 after serving eight years as sales manager of the Springfield (Ohio) Light, Heat & Power Co. He has been in charge of the residential sales divi-



J. E. North

sion since 1934. Mr. North received the James H. McGraw Medal and Purse for Co-operation for 1933. The citation read in part: ". . . president of the Electrical League of Cleveland, pioneer in the co-operative development of the local electrical market, for fifteen years he has been the guiding genius of the oldest community association of the electrical trade. . . . Through the success of his progressive programs for co-ordinated sales promotion and the improvement of the economics and ethics of the electrical trade in Cleveland, he has become the outstanding figure in the field of local market development in the electrical industry. . . ." Mr. North has been president of the Electrical League of Cleveland for more than 20 years and is a past-president of the International Association of Electrical Leagues.

•

► DR. C. EARL WEBB, designer of bridges and western division engineer of the American Bridge Co., Chicago, has been elected president of the Western Society of Engineers for the year 1943-44.

► W. A. YOST, JR., formerly connected with the Elliott Co., Jeannette, Pa., has been appointed manager of the marine division of the steam turbine department, Allis-Chalmers Manufacturing Co., Milwaukee. Mr. Yost was manager of the Elliott Co.'s turbine department when he severed his connection with

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- SEAL SPLICES AGAINST MOISTURE
- MAKE OIL-TIGHT TERMINALS

The use of Harvel Oil Stop as a binder between layers of insulating tape has solved, for many utilities, the problem of making cable splices oil-tight and moisture-proof. This method effectively seals splices, stop joints and terminals—keeps oil in and water out—prevents insulation failure and loss of power. Cable splices and stop joints made with Harvel Oil Stop show no signs of failure after 6 years of service. Cable terminals treated with Oil Stop 9 years ago are still operating successfully. In many cases, use of Harvel Oil Stop eliminates the need for a barrier-type stop joint—in others, it saves the cost of a pothead.

CHECK THESE FEATURES AGAINST YOUR REQUIREMENTS

Oil Stop is a phenol-formaldehyde resin which, applied as a liquid, polymerizes quickly into a firm, enduring, infusible insulation at ordinary room temperatures. It will adhere satisfactorily to rubber, oil-impregnated paper, fibre, Bakelite and copper.

Oil Stop is non-inflammable, will not melt or soften after setting, and is not affected by acid and alkali solutions. Its electrical properties of dielectric strength, dielectric constant and power factor are extremely favorable.

Oil Stop, in addition to being oil-proof, moisture and weather proof, is non-corrosive. It has found a wide variety of applications underground and in the electrical industry generally for cable splicing, making oil-tight terminals, and stop joints.

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If you are doing bending work now with obsolete or makeshift equipment, you'll find Greenlee Hydraulic Benders are 3 times faster. One man can operate . . . smooth, accurate bends are made in a jiffy. There's no wrestling of heavy conduit or equipment . . . all Greenlee Benders are light, portable, and compactly built. Model No. 770, shown at left, has 25-ton capacity — bends 1¼" to 3" pipe or conduit. A 40-ton unit handles 3" to 4½" material. Send for Catalog 33-E.

NO. 770 RIGID CONDUIT AND PIPE BENDER

STEEL TUBE BENDER

Whatever you have to bend — tubing, conduit, pipe, or bus bar — there's a Greenlee Bender to do the job in a jiffy. Shown above is the No. 763 Greenlee steel tube bender for bending ¼" to ¾" steel, copper, brass and aluminum tubing. For full details, write for Booklet S-116.

KNOCKOUT-TOOLS

Greenlee knock-out punches and cutters are fast operating, too . . . are old "stand-bys" for the electrician. They enlarge holes in conduit boxes and cabinets without drilling, reaming, and filing. They are made from high-grade steel, and are properly heat-treated to stand the strain and stress of hard usage. They are, today, saving hundreds of contractors vital hours on war jobs. Write for Catalog 33-E.

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The Mark of Good Insulators . . .

that organization to join Allis-Chalmers. He had been with the Elliott Co. for 16 years, affiliating himself with it following graduation from North Carolina State College in 1927. In his new position Mr. Yost will have charge of the greatly expanded production of marine propulsion and auxiliary generating equipment which Allis-Chalmers is providing for many types of Navy ships and for the U. S. Maritime Commission's Victory ship program.

► L. A. NETTLETON, formerly assistant engineer, Consolidated Edison Co. of New York, Inc., has joined the Massachusetts Institute of Technology.

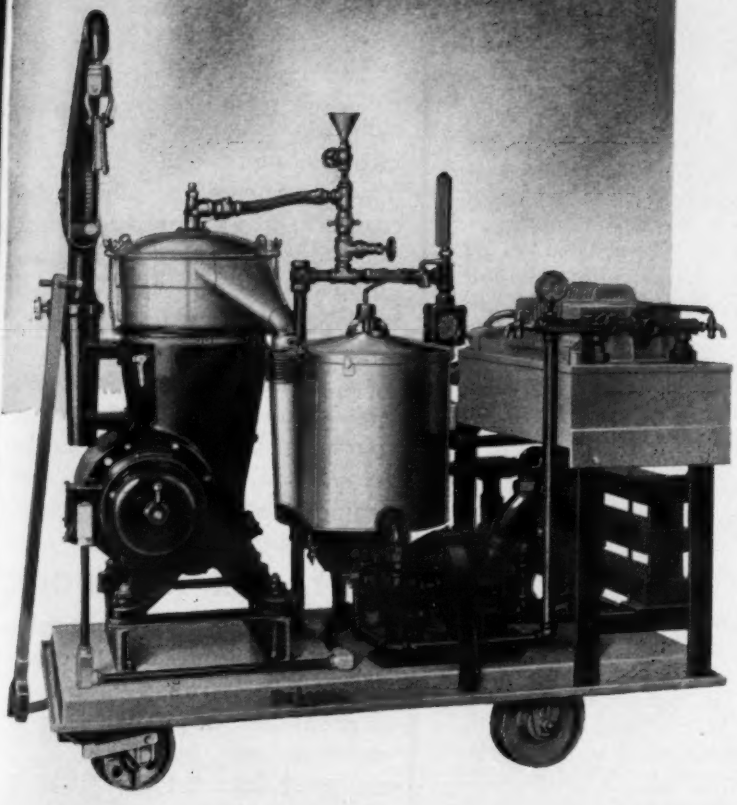
► DR. THOMAS E. FRENCH of Ohio State University engineering department was recently awarded the Lamme medal for achievement in engineering education at the annual dinner of the Society for the Promotion of Engineering Education at the Drake Hotel, Chicago. Dr. French was chosen for this award, the highest of the society's gifts, because of his record as a teacher and as a writer of textbooks. The presentation was made by Dr. Henry T. Heald, retiring president of the society and president of the Illinois Institute of Technology.

► ROBERT S. CLUBLEY is a new industrial lighting engineer on the staff of the General Electric lamp department, Los Angeles. His experience includes 17 years at the company's headquarters at Nela Park. He was recently dismissed from the Army Air Corps because of the over 38 ruling. He served in the Air Service Command at San Antonio, Tex., and at Kelly Field as electrical specialist on aircraft equipment.

► A. M. WIBEL has been elected vice-president of Nash-Kelvinator Corp. Until recently Mr. Wibel was vice-president and a director of the Ford Motor Co. Joining the Ford organization 31 years ago, Mr. Wibel was promoted from engineering clerk to head of engineering purchasing, then in 1927 to director of purchases, and to vice-president and director in 1941. Since 1939 he has had the added responsibility of all of the company's government sales contracting, involving more than $4,000,000,000 worth of war work.

► THEODORE D. REIMERS, JR., formerly a division engineer in the electrical engineering department of Consolidated Edison Co. of New York, has been appointed electric superintendent at the Hudson Avenue station of the Brooklyn Edison Co. He succeeds R. S. WILLIAMS, who is on a wartime leave. Mr. Reimers was first employed by the Consolidated Edison System in 1923 as a clerk in transmission and distribution. While attending Cornell University,

Higher Purifying Efficiency PLUS Higher Daily Capacity



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The De Laval Insulating Oil Purifier operates efficiently with oil at relatively low, non-carbonizing temperatures and, except for removing colloidal carbon from circuit breaker oil, uses no filter media . . . two more savings which add to its economy.

Speedier, less costly oil purification, which is also more positive, leads to improved dielectric value of oil in all units, contributing directly to dependable substation performance.

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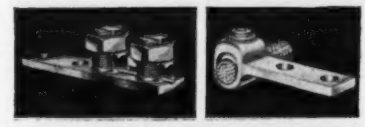
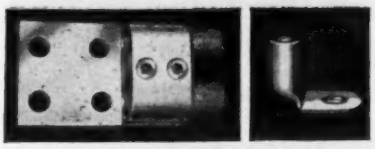
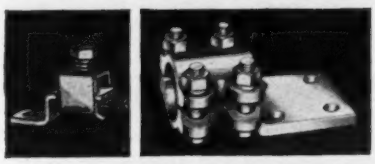
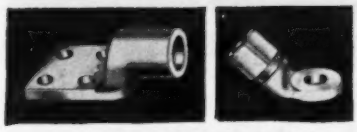
Look in the Penn-Union Catalog —all of the good types: Solderless lugs to grip the conductor by Bolt, Screw, Post-and-Nut, or Multi-Slit Tapered Sleeve . . . Soldering lugs, Cast and Stamped, in wide variety . . . Here are just a few:









You will also find the most complete line of Cable Taps, Tee Connectors . . . Straight, Parallel, Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Service Connectors.

Penn-Union fittings are preferred because every one is mechanically and electrically *dependable.* They are the first choice of leading utilities, industrials, electrical manufacturers, contractors. *Write for the Penn-Union Catalog.*

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ERIE, PA. *Sold by Leading Jobbers*

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Conductor Fittings

from which he was graduated with a degree in electrical engineering in 1927, he continued to spend his summer vacations working for the company in various capacities in the testing and engineering fields.

▶ROBERT C. HILL and J. G. BARIESAS have been appointed assistants of President Tom P. Walker of the Council of Electric Operating Companies in a move to replace the late William L. Hoos and to carry out normal expansion of the council's Washington staff. Mr. Hill joined the Council after operating his own business in New York City. Previously he had been an independent sales counsel in New York and affiliated with the Westinghouse Electric & Manufacturing Co., Philadelphia Electric Co., Cleveland Electric Illuminating Co. and the United Gas & Electric Corp. He is a native of Bethlehem, Pa. Mr. Bariesas was director of advertising and publicity for the Virginia Public Service Co. in Alexandria before joining the Council. He is a native of Philadelphia and a graduate of the University of Virginia.

▶GEORGE E. MILLER, who has been connected with the Cleveland Electric Illuminating Co. since 1910, has retired. In 1907 Mr. Miller became district manager of the Westinghouse Electric & Manufacturing Co. in Cleveland, having been previously associated with Westinghouse in the East. During his 33 years with the Cleveland utility he held various executive positions, including that of sales manager. He handled many special assignments, including work on the War Industries Board during World War I. In 1909, with other members of the local electrical fraternity, he organized the Electrical League and was elected president. Since that time he has taken a prominent part in league activities and at the present time is serving on the board of directors, as he has for many years.

▶C. H. SANDERSON, system planning engineer, Consolidated Edison Co. of New York, has retired. Mr. Sanderson commenced his engineering career in 1901 with a year of shop work at the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., after which he was transferred to the drafting department. In 1906 he did switchboard and power-station design and in 1919 was given supervision of this work for the eastern United States and all foreign trade. As general engineer from 1911 to 1913 he assumed the duties of commercial engineer salesman. He worked as electrical engineer for the Havana (Cuba) Electric Railway, Light & Power Co. from 1913 to 1917. His association with the New York Edison Co. dates from 1921, when he

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Let us help apply automatic time controls to one or more of your operations. Just give us the details and one of our Timer Engineers will make recommendations without obligation.

WRITE FOR THIS BOOK

. . . Describing industrial timers, time-switches and other time controls. Contains illustrations, construction and installation data, list prices and reference information.

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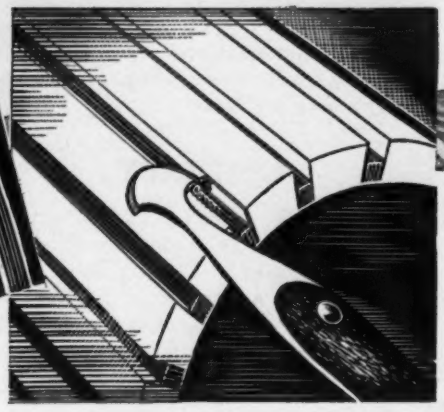
The A B C of Good Commutation and Electrical Machine Performance

● Serious shutdowns and consequent delays in the production and delivery of urgently needed materials can be avoided by observing these simple precautions in the maintenance of motors, generators and converters. Under present conditions, dependable and uninterrupted performance of electrical power equipment is of utmost importance. Keep your machines in readiness to deliver full output at all times.

a Keep Commutators and Rings Clean

Cleanliness is of paramount importance in the continuous operation of brush-using equipment. Time spent on keeping commutators, rings, brush holders and rigging free from dust, dirt, oil and film pays dividends. Use a suitable canvas wiper frequently on commutators and rings. Keep them clean and keep them running.



b Keep Undercut Commutators Free from Side Mica

Thin edges of mica along the sides of slots of undercut commutators are a frequent source of trouble. Special care should be taken to inspect each slot carefully and to remove all side mica when undercutting commutators. Bad sparking and serious commutator burning can be avoided by observing this precaution.

c Keep Brush Pressure Uniform and Correct

The spring pressure applied to brushes has a marked influence on brush performance. Equal distribution of current among all brushes requires that the pressure on all brushes be kept as nearly equal as possible. Check brush pressure frequently and adjust it to compensate for brush wear. Use pressures recommended for the grade of brush and class of service in which it is used.

MODERN PYRAMIDS will tell you more

This series of bulletins contains practical information on Commutation, Brush Operation and Machine Maintenance to help conserve present equipment and to keep it in continuous and efficient operation. If you are not receiving these bulletins write us direct or contact your National Carbon representative.

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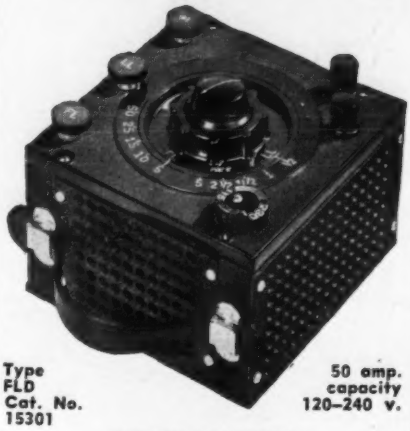

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50 amp. capacity 120–240 v.

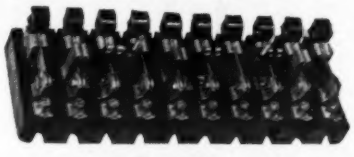
EQUIPPED WITH FULL LOAD—LIGHT LOAD SWITCH

Current Steps: FL—5, 10, 15, 25, 50
LL—½, 1, 1½, 2½, 5, amp.

When the rotary switch is set up for the FL value desired, the 10% LL setting is made automatically. The FL-LL switch makes shifting from LL to FL and vice versa an easy matter.

Test Blocks

for simplifying the installation and testing of watthour meters and relays. Now, more than ever, test blocks for meter and relay installations ARE NEEDED to protect personnel and property.



Type SJ

Many are Standardizing On STATES Test Locks because—

1. **No live parts extend beyond base —an important safety feature.**
2. **Large selection of pole arrangements available.**
3. **Maximum pressure of jaw contacts and many other distinctive features.**

- - - - *Tear off and Mail Today* - - - -

To THE STATES COMPANY
Hartford, Conn.

Please send full information on Phantom Loads and Test Blocks.

Name .....Title.....

Firm .....

City .....State.....

took the position of assistant electrical engineer and assistant system engineer. In 1937 he was made system planning engineer. Mr. Sanderson has written and edited books and is editor in chief of "American Standard Definitions of Electrical Terms." He is a fellow of the American Institute of Electrical Engineers.

► ROBERT M. KEENEY, for the past 16 months connected with the WPB at Washington, D. C., first as chief of the nickel section in the steel division and lately deputy director of the general industrial equipment section, has returned to the Connecticut Light & Power Co., at Waterbury, where he will be occupied for the present with research on new business problems such as post-war planning, cost investigations in relations to loads, and rate studies. Before going to Washington Mr. Keeney was active in the company's industrial engineering work, specializing in heating and power problems.

OBITUARY

► MAJOR W. DOUGLAS BROWN, vice-president of the Canadian Niagara Power Co., died at Niagara Falls, Ont., on June 29, at the age of 55. Major Brown also was the company's manager of operations at Fort Erie, Ont.

► HALLMER C. PETERSON, 51, former district superintendent of meters for the Indiana & Michigan Electric Co., died at South Bend, Ind., on May 17.

► HENRY P. DODGE, retired electrical engineer, who was president of the H. P. Dodge Engineering Co., died on June 17 in Toledo, Ohio, after a short illness. Mr. Dodge was a member of the American Institute of Electrical Engineers.

► KARL KING, general superintendent of the Wickwire Spencer Steel Co. plant at Palmer, Mass., died on June 26 at his home in that city, at the age of 63. Mr. King was graduated in 1904 from the Massachusetts Institute of Technology, where he subsequently taught for several years. He became assistant superintendent of the Worcester plant of the American Steel & Wire Co. in 1906 and three years later organized a mill for that organization in New Haven. He was instrumental in organizing Wentworth Institute in 1911 and taught there for several years. Mr. King was a member of the American Petroleum Institute and had served on several of its committees. He also was a member of the technical committee of the Wire Rope Association, a director of the Iron and Steel Institute of London and a member of the American Society of Metals and of the American Society of Mechanical Engineers.

SAVE THE POLES

• The Sturd-E exclusive Multipoint Cant Hook speeds up pole handling and saves the poles—its six quarter-inch by half-inch points grip much more firmly than a single point—in addition, they do not penetrate the creosote treatment. Result—no deep stab wounds where water collects and rot can start.

Made in three sizes for handling all poles—from the smallest to the big ones 22 inches in diameter. Every utility that has tested the Multipoint Cant Hook has reordered in ever increasing numbers—it saves poles, time, and cost.

STURD ETOOLS
a **TRUE TEMPER PRODUCT**

MULTIPOINT CANT HOOK

6 points, ¼" x ¼" in size grip the pole securely but leave no deep hole to encourage rot and decay. Points renewable when worn. Furnished in small, medium and large sizes for handling poles up to 22" in diameter. Prices and complete description on request.

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In World War I, Wakefield made riding lights, bulkhead lights and "blinker guns" for the Navy. Today we're in war service again.

First in Peace . . . First in War . . . Wakefield

WE'RE mighty proud to be the first in our field to fly the Army and Navy "E". This tops a series of Wakefield "firsts" which have brought the benefits of improved lighting to millions through our 37 years of peace and war service.

We're especially proud of this honor:

Because we know that our equipment has helped save fighting ships and the lives of your sons at sea; because we're helping others to do their best in the battle of production.

Because to us it stands for the untiring efforts of all our workers . . . for their readiness to work long hours at any time, if necessary to get the job out . . . for their willingness to switch to new duties, even at a temporary personal loss . . . for their loyalty which has put aside grievances, never letting them delay war production.

Because it stands for ingenuity in making available equipment perform new work to speed delivery . . . in developing new equipment to fit wartime needs and conditions.

Because, more than ever, it makes us conscious of our part in the war effort, and eager to do all that we can on Today's Biggest Job.

THE F. W. WAKEFIELD BRASS CO.

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★ **Fluorescent and Incandescent Lighting Equipment for War Production, Damage Control Lights, Binocular Blinker Lights, Mine Buoy Lights, Army Marker Lights, Floating Lanterns, Cabin Lights for Liberty Ships and troop transports, Airplane Motor Parts, Navy Blackout Shields, Blackout Trouble Lights, Lighting Specialties for Military Use.** ★

MANUFACTURING-MARKETS

New Era Predicted in Plastics Uses

Wartime research developments in laminated plastics being applied to vital military uses will open a new era of peacetime consumer applications, three representatives of the Formica Insulation Co., disclosed at the recent annual meeting of the Ohio Mechanics Institute.

Presentation of the informative review of laminated plastics, their development, present wartime applications and post-war possibilities was in the nature of a tri-partite program conducted by J. D. Cochrane, Jr., and John C. Pitzer, chemical engineers, and George F. Schatz, engineer in charge of architectural materials for the Formica company. Morrison R. Waite, president of the Institute, was chairman of the meeting. The program was arranged by D. J. O'Conor, Formica president and board member of O. M. I.

Expressing belief in the post-war applications of plastic materials in the fields of industrial, architectural and commercial design, Mr. Schatz said "the new uses will provide a new era. Designers of automobiles, buses, trains and ships will demand lightweight materials which will withstand hard usage and at the same time be of a definite decorative value. Architects and designers will demand impervious materials in varied colors and designs. There is a definite trend toward the pre-fabrication and semi-fabrication of dwellings and other types of buildings." In discussing Formica's place in this program, Mr. Schatz stated that "at the present time we have many materials in the process of development which we expect to complete within a very short time. . . ."

•

Refund Agreement Made

Blaw-Knox Co. has announced conclusion of an agreement with the Navy Price Adjustment Board calling for the refunding of $4,500,000 to the government in 1943 in settlement of renegotiation of its war contracts for all periods to December 31, 1942. After giving effect to renegotiation, the company stated its net working capital is $8,637,769.

"NO REJECTIONS"—President A. F. Wakefield of the F. W. Wakefield Brass Co. thanks Capt. Ross P. Schlabach, inspector of naval materials, Cleveland district, for his compliment to employees and the management of the company on their record of "no rejections and less than 1 percent unexplained absenteeism" in the production of naval materials. In foreground, left to right, at the presentation of the Army-Navy "E": Fred Friday, president, IBEW local; Mrs. F. W. Wakefield, Sr.; Capt. Schlabach; Ward Harrison, director of engineering, G.E. lamp department, and Lieut.-Col. Earl F. Baskey

•

Manufacturers Issue Earnings Reports

Line Material Co. for the March quarter reports net income, after $128,400 income taxes, of $176,016, equal to 41 cents each on 427,232 shares, against $101,964, or 24 cents a share, after $147,637 taxes for last year's period. Net sales totaled $2,708,379, against $2,489,042.

Among the other companies reporting earnings were the following:

WESTON ELECTRICAL INSTRUMENT — Including subsidiary for first quarter, net profit $194,414, or $1.21 a share, after charges and a provision of $2,499,700 for contingencies, including an estimated adjustment in prices on war contracts and estimated Federal income and excess profits taxes, after a deduction for the post-war refund of 10 percent for excess profits taxes based on the Revenue Act of 1942. After a reserve of $67,300 for post-war adjustments, the balance transferred to earned surplus was $127,114, or 79 cents a share. For the first quarter of last year, net income amounted to $118,140, or 73 cents a share.

AMERICAN INSULATOR — March quarter, net income after $6,340 reserve for contingencies and post-war adjustments and $109,200 for all taxes was $29,643, compared with net income of $15,346 for the similar period last year. Gross sales totaled $646,911, compared with $371,432.

AMERICAN TRANSFORMER—For year 1942, net income, after $467,300 Federal income and excess profits taxes, $161,231, equal to $2.93 a share, against 1941 net of $178,736, or $3.25 a share after $324,941 tax deductions.

COLLYER INSULATED WIRE — For year 1942, net income, after $384,585 Federal income tax and $4,606,532 excess profits tax, $1,616,997, comparing with net income of $252,832 after $350,320 taxes the year before. Net sales totaled $18,994,856, compared with $10,497,917.

•

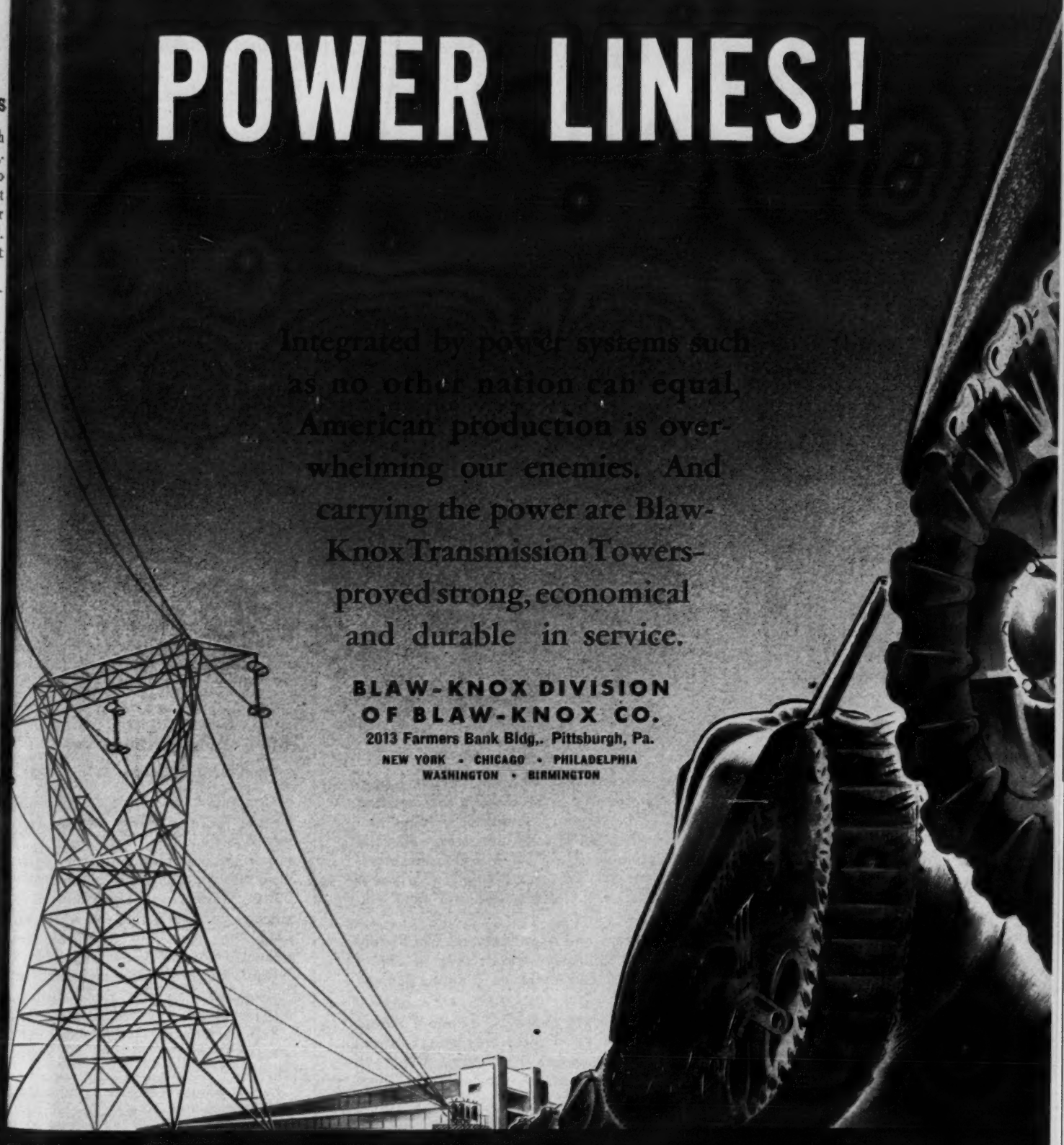
G.E. Supercharger Output Soars in Current Year

Six months from the time steel was delivered for General Electric's mammoth new supercharger plant in Fort Wayne, Ind., shipment was made of the first carload of completed units for the U. S. Army. This was 60 days ahead of schedule and but 15 days after the first supercharger was produced, according to information released recently by the General Electric Co.

The building, largest of all General Electric factories and with its equipment representing a Defense Plant Corporation investment of approxi-

Behind the Production Lines...

POWER LINES!



Integrated by power systems such as no other nation can equal, American production is overwhelming our enemies. And carrying the power are Blaw-Knox Transmission Towers—proved strong, economical and durable in service.

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BLAW-KNOX TRANSMISSION TOWERS

★ ★ ★ FOR VICTORY BUY U. S. WAR BONDS AND STAMPS ★ ★ ★

As, for example,

This RUGGED ASCO SWITCH for Heavy Duty Remote Control

ASCO *Electrically Operated* SWITCHES

You're asking about our Electrically Operated Switches? . . . what types we make? . . . for what service? . . . who uses them?

We make a complete line of magnetically held and mechanically held switches for heavy duty . . . "as, for example," the 3-pole, 800 ampere Remote Control Switch illustrated. Our standard Transfer Switches and Remote Control Switches have capacities up to 1000 amperes, 750 volts AC or DC, inductive or non-inductive loads. We make Contactors, Relays, and Control Panels; also Solenoids. Circular 560 will give you a brief description of our line of switches. Catalog 561 will give you complete technical data.

Our experience? Well, we have designed and manufactured Electrically Operated Switches since 1888. Our products are widely used in utility, industrial and marine applications. We can make reasonably prompt deliveries on proper priority rating.

We also invite your attention to the many types of ASCO Solenoid Valves for controlling such operations as: steam, fuel oil and water lines; lubrication and refrigeration systems; turbine emergency shutdowns. We have packless and packed types; explosion-proof types; also strainers and filters for protecting these valves.

Automatic Switch Co.

41-C East 11th Street, New York, 3, N. Y.

TELL US WHAT YOU WISH TO ACCOMPLISH

mately $25,000,000, covers a plot of more than 788,000 sq.ft. The first steel was delivered on March 9, 1942, and on June 13, or three months later, the first equipment was started. By the first of the year the output was at the rate of $1,000,000 a month and today has jumped to $3,000,000, according to Lisle Hodell, superintendent of the plant.

•

Westinghouse Sublets $173,000,000 Orders

Since inaugurating its spread-the-work policy early in 1941, the Westinghouse Electric & Manufacturing Co. has awarded approximately $173,000,000 of war orders to subcontractors, a report to directors of the company has disclosed. The subcontracts concerned represented an estimated 52,000,000 man-hours of work, or the equivalent of keeping more than 26,000 men busy for a year on the basis of a normal working day, A. W. Robertson, chairman of Westinghouse, pointed out.

For 1942 alone the company's subcontracting program involved more than $100,000,000 and during the first five months of 1943 a total of $45,000,000 in subcontracts was awarded, Mr. Robertson said.

One-third of the 1,367 firms which received Westinghouse subcontracts so far in 1943 appeared on the list for the first time, acording to the announcement.

•

More Plants Receive Army-Navy "E" Award

The Navy Board for Production Awards has granted to the De Laval Steam Turbine Co., Trenton, N. J., a second renewal of the right to fly the Navy "E" Flag with two white stars.

Army-Navy award for continued excellence of production—a white star added to the "E" flag—has been presented to the Emporium plants of Sylvania Electric Products Inc., and Philco Corp., Simplex Radio Division, has just been awarded a white star.

Bell Telephone Laboratories have been awarded the "E" for the second time.

Other plants recently awarded an "E" include: General Electric Co., plastics department, plant No. 1 of Pittsfield, Mass.; Westinghouse Electric & Manufacturing Co., meter division, Newark, N. J.; Blaw-Knox Co., Blaw-Knox division, Blawnox, Pa., and National Battery Co., Gould commercial division, Depew, N. Y.

Field Reports on Business

Electrical industry reports high backlog of business for motors and generators, though orders are beginning to decline sharply. Steel output was off sharply last week, due to coal strike. Retail trade continued active, department store gains ranging up to 25 percent over last year.

NEW YORK

A record for electricity generated by the Consolidated Edison Co. of New York system was established June 29, when a total of 31,220,070 kw.-hr. was generated. Previous high, according to company officials, was 29,779,500 kw.-hr. on June 25.

Retail sales, which have been holding up at levels well in advance of the same period a year ago, should slacken off soon due to shortages of available merchandise. Department store sales nationally were up 19 percent for the week ended June 26, according to the Federal Reserve Board, compared to 28 percent the week previously. For the four week period ended June 26 the rise was 19 percent. This checks with a New York *Times* survey showing sales averaging 20 percent higher in June than in June, 1942. With no diminution of public purchasing power or demand, and with inventories at the last report off some 26 percent from the same period in '42, an inevitable contraction in sales should not be long in forthcoming.

Civil engineering construction totaled $60,148,000 for the week, 12 percent higher than in the previous week, but 72 percent below the volume for the corresponding week in 1942, according to *Engineering News-Record*. June construction totaled $274,493,000, an increase of 0.3 percent over May, but also 72 percent below the $968,938,000 reported for June, 1942.

NEW ENGLAND

New England engineering consultants are turnind toward post-war changes in industry and are in the early stages of reviewing modernization opportunities and the transposition of production from wartime to civilian requirements.

War contracts in this area have nearly reached the $10,000,000,000 mark. The "cutback" program of the government seems likely to affect this territory less than some other regions because, according to W. H. Wheeler, director of the WPB in New England, production emphasis will be shifted to other types of war material and equipment, notably ships and aircraft accessories.

North Attleboro, Mass., contemplates a future purchase of feeder regulators as an economy measure to replace units now belonging to a neighbor utility. Central Maine Power reports a slight increase in residential revenue for the first five months of 1943, more than offsetting a reduction in income from commercial lighting customers in this period. Electric appliance sales are "rocking along" toward the edge of the available stocks in New England utilities, and vigorous efforts are being made to encourage the more careful use and maintenance of existing equipment.

Several utility steam plants are seriously considering early conversion from oil burning to stoker or pulverized coal firing, supplementing work in this area completed or nearly finished in a number of the larger generating stations. It is expected that some hydro-electric plant construction will follow the termination of the war, with further improvements in interconnection facilities. About $8,000,000 in hospital construction has been authorized by the federal government for New England this year, and a proportionate quantity of wiring, power and lighting material and equipment will be required in these installations.

PACIFIC COAST

At midyear most electrical manufacturers and wholesalers on the Coast report that, contrary to many budgets, their volume of business has equaled or even exceeded that of the corresponding period of 1942. When one construction factor, such as service bases, fields, and camps, tapers down to maintenance or an occasional "enlargement of facilities," another takes its place.

Housing construction, considered to be nearing an end about September so far as large jobs were concerned, has been reawakened by a new Washington program intended to provide 330,000 new units by July 1, 1944, of which 90,000 each will be publicly or privately owned, and the remainder conversions. It is estimated that 25 percent of these would be assigned to California, Nevada, and Arizona.

Fractional horsepower motors are in heavy demand. There were recently requested five thousand ½ hp. blower motors on a 60-day delivery basis for dormitory and barrack service; and an order covered 1,000 G.E. pumping motors, costing $25,000. Cable orders include $20,000 requisitions for drydocks in California and Hawaiian Islands; and a $700,000 ship cable order for a fleet of cargo carriers. Two 47-ton diesel-electric locomotives, value $90,000, were recently shipped overseas.

Fifty-seven miles of rural electrification have been re-docketed in Idaho for early construction, principally near Graigmont.

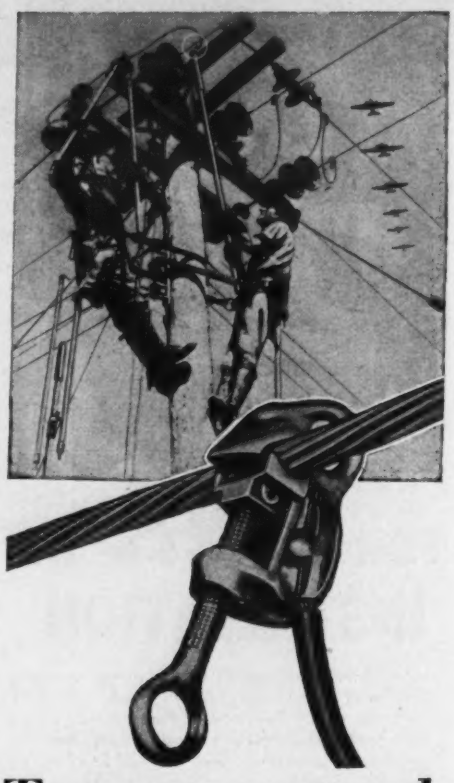
CHICAGO

Recent developments in the Seventh Federal Reserve District, with Chicago as its center, lend credence to predictions that over-all industry production is nearing an all-time record peak, according to the Federal Reserve Bank there. Additional output, forthcoming, must come principally from more expeditious use of available manpower and materials rather than possible limited expansion of already overextended supplies.

On the manpower front the "quit" rate in manufacturing, excluding selective service withdrawals, in March was 5.36 percent per 100 employees, as compared with 3.02 for March, 1942, according to the Bureau of Labor statistics. Layoffs and discharges declined from 1.52 to 1.09 persons per 100 in the same period. A flurry of threatened and actual work stoppages, including the coal controversy has affected a number of industrial plants. Interruptions for short periods have occurred in such leading centers as Chicago, Detroit and Indianapolis.

Very few of the recent war contracts have been for electrical equipment. Some electrical equipment is being moved, however, between private utilities under the Controlled Materials Plan of WPB.

Department store sales in the Chicago area were up 13 percent for the week of June 26 over a year ago and an equal amount for the four weeks ended June 26 over the same period last year.



Tap new steel conductor extensions "hot" with TIPS G-P clamps

Tips G.P. (General Purpose) hot tap clamps are just the thing for use on line extensions authorized by W.P.B.'s Supplementary Utilities Order U-l-c. These zinc coated bronze clamps have been used for years to form a contact between dissimilar metals and have proven completely satisfactory in service on aluminum to copper, copper to steel or aluminum to steel connections. Tips G.P. clamps are of the same design as other types of Tips tap clamps having three point contact with the conductor tightened by means of the eye screw. A pressure screw makes a tight dependable contact for the jumper wire. They may be applied hot with Grip-All or other clamp sticks. Use them on all types of connections and avoid present or future service interruptions.

CONSULT THIS BOOK

A·B·CHANCE CO. CENTRALIA MISSOURI

EVERSTICK ANCHORS...

FOR SPEED IN INSTALLATION

The exclusive Everstick nut housing locks the Anchor firmly on the rod. This speeds up installation. Plates are so designed, that they expand easily into undisturbed earth, and extra holding power is achieved. Made of tough, rust-resistant malleable iron. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

TEST INSULATION . . . . .
the modern, easy way with a
MODEL B-5
MEGOHMER

No more tiresome cranking of a hand-driven generator . . . Our new battery-vibrator type insulation testers operate at a steady test potential of

500 VOLTS DC

available at the touch of a switch, portable, entirely self-contained, direct-reading.

Write for bulletin No. 430.

HERMAN H. STICHT CO., INC.
27 PARK PLACE NEW YORK, N. Y.

New REA Allotments Total $753,000

Allocations totalling $753,000 to 18 REA cooperatives in 13 states were announced recently by the Department of Agriculture. Funds borrowed under these allocations will be used to acquire existing properties which will facilitate the electrification of additional farms in the post-war period, and to finance facilities already completed in accordance with War Production Board regulations, including extensions under WPB's recent order U-1-c, permitting connection to nearby rural power lines of farms producing livestock, dairy and poultry products.

Rural Electrification Administrator Harry Slattery, in announcing the allotments, said that no new construction would be undertaken except in accordance with authorization or regulation of the War Production Board.

Total allotments to date are $466,945,465, of which $8,224,550 represents operations during the current fiscal year.

Included are the following:

ARIZONA—Sulphur Springs Valley Electric Cooperative, Inc., Willcox, $345,000.

KENTUCKY—Clark Rural Electric Cooperative Corporation, Winchester, $10,000.

MINNESOTA—Minnesota Valley Electric Cooperative, Jordan, $61,000; Blue Earth-Nicollet Cooperative Electric Association, Mankato, $25,000; Todd-Wadena Power & Light Association, Wadena, $20,000.

MISSOURI—Lewis County Electric Cooperative Association, Monticello, $25,000; Ralls County Electric Cooperative Association, New London, $15,000.

NORTH CAROLINA — Edgecombe-Martin County Electric Membership Corporation, Tarboro, $15,000; Randolph Electric Membership Corporation, Asheboro, $10,000; Piedmont Electric Membership Corporation, Hillsboro, $10,000.

OKLAHOMA—Central Rural Electric Cooperative, Stillwater, $75,000; Alfalfa Electric Cooperative, Inc., Cherokee, $33,000; Verdigris Valley Electric Cooperative, Collinsville, $20,000.

OREGON—Wasco Electric Cooperative, Inc., The Dalles, $8,000.

PENNSYLVANIA—Central Electric Cooperative, Inc., Parkers Landing, $20,000.

VIRGINIA—Shenandoah Valley Electric Cooperative, Dayton, $28,000; Northern Neck Electric Cooperative, Warsaw, $25,000.

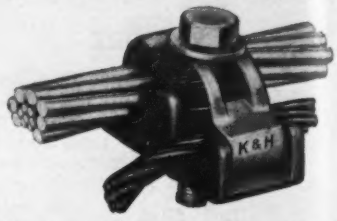
WASHINGTON—Chelan County Electric Cooperative, Inc., Leavenworth, $8,000.

•

Record Tonnage Quarter

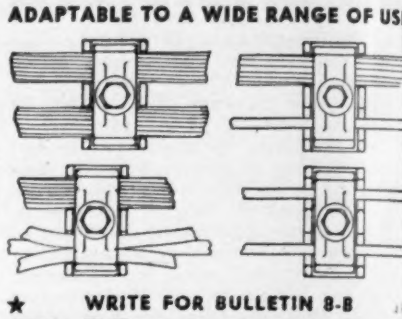
American Brass Co. has nearly trebled its output of fabricated copper and copper alloys since 1939 and is now turning out brass for ammunition alone at eighty times its 1939 volume of production. Exact figures are secret. By far its greatest tonnage quarter was achieved for the first three months of 1943.

is no better than its
UNIVERSAL Tap Connecto



Effectively used as guy line ground, transformer and lightning arrester connection to A. C. S. R. or copperweld conductors where the diameters may be from 8 copperweld to .595" A. C. S. R. armor rods. Wire sizes .595" to 5/32".

ADAPTABLE TO A WIDE RANGE OF USE



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K&H KRUEGER & HUDEPOHL
Solderless Terminal Lugs and Connectors
E. VINE AT THIRD • CINCINNATI, OH

STAR METER SEAL

Eliminates meter tampering. Cannot be removed without mutilating. SEND FOR SAMPLE.

STAR PORCELAIN CO.
51 Muirhead Ave. Trenton, N. J.

Air Cooled TRANSFORMERS
Write for Air Cooled Transformer Bulletin

1/10 to 50 KVA single and 3 phase up to 2400 volts primary.

THE ACME ELECTRIC & MFG. CO.
43 WATER ST. CUBA, N. Y.

Acme Electric

BOOKS RECEIVED

Industrial Electricity and wiring (Third Edition). James A. Moyer and John F. Wostrel. McGraw-Hill Book Company, New York. 541 pages, illustrated. Price $2.75.

Brought into concordance with the 1940 N.E.C. (except for retention of 1937 carrying capacities), the third edition also has new chapters on fluorescent lighting and radio interference.

College Physics (abridged). By Henry A. Perkins. Published by Prentice-Hall, Inc., New York. 0 pages, illustrated. Price $3.50.

This is a simplification-revision of the 941 abridged edition of the more comprehensive volume reviewed in the ELECTRICAL WORLD of July 16, 1938, page 92 revised form May 15, 1943, page 139).

Engineering Problems Illustrating Mathematics. John W. Cell. McGraw-Hill Book Co., New York. 172 pages, illustrated. Price $1.75.

Probably nine out of ten college-trained engineers will, when confronted with the translation of an engineering situation into mathematical symbolism, recall certain tables of trigonometric, analytic geometry and calculus relations in the hope of finding "the one that fits." This book of 500 answered problems from all engineering will do more to disrupt that kind of subservience than anything known. Its merit lies in the fact that it is an S.P.E.E.-committee sponsored assembly and that it was inspired by R. E. Doherty, who surpasses in his zeal to establish mathematics as the handmaiden of the inquisitive and resolute engineer.

Symposium on Radiography. Published by American Society for Testing Materials, Philadelphia. 256 pages, illustrated. Price $4.

A collection of 20 papers including abstracts of five presented at the 1936 symposium, thirteen of the 1942 symposium, plus two added for completeness (particularly the A.S.T.M. recommendations for terminology definitions). Measured from the standpoint of the electric utility engineer something like a third of the book deals with the foundations and the specific tooling of radiography to disclose flaws in boiler plant and station auxiliaries and high pressure piping. Being a committee-sponsored treatment, the reader can have confidence in an impartial presentation of the art of radiography and its devotion, case by case, to the flaws which it will uncover at critical places in important equipment subjected to stress.

Fundamentals of Applied Electricity. By E. W. Stones. The Bruce Publishing Co., Milwaukee. 341 pages, illustrated. Price $2.60.

A "do" book rather than "listen" one, the aim is to serve the vocational course. International electrical pioneers grace occasional pages to offset the utilitarian motive by respect for the origination of now-familiar concepts. Formulated procedures and review quizzes terminate each chapter to press home the elements of meters, batteries, circuits, systems, transformers, radio, small motors, appliances.

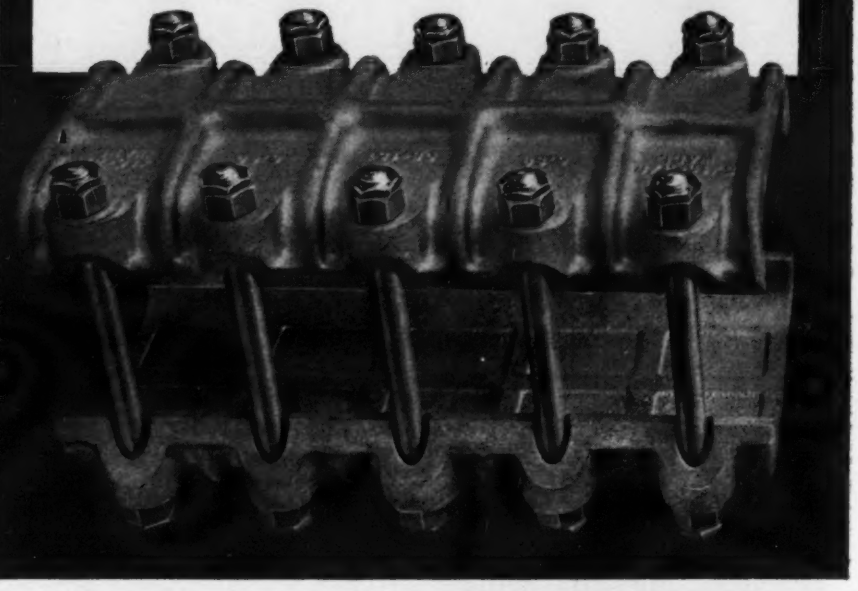
Pre-Service Course in Automotive Mechanics. By James V. Frost. John Wiley & Sons, Inc., New York. 545 pages, illustrated. Price $2.50.

Familiarizes one with the functions and locations of the various units of a car or truck along with principles of action and guides to best upkeep—whether in civilian or military service.

BUS BAR FITTINGS and CONNECTORS
Must* Stay Tight . . . and they *DO

Shown below is Delta-Star type "CS" Connector using PALNUTS on all bolts. The Delta-Star Electric Company also uses PALNUTS on its well-known line of clamps, taps, terminals and multiple fittings.

when locked with
PALNUTS

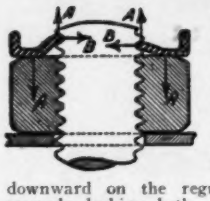


For Security — Specify
DOUBLE LOCKING PALNUTS

The security of your bus fittings and connectors depends largely upon their bolted fastenings. To prevent these vital nut-and-bolt assemblies from loosening in service, many prominent manufacturers equip their fittings and connectors with Double Locking PALNUTS. This simple, inexpensive precaution assures connections that stay tight under severe vibration and stresses.

Double Locking PALNUTS are single thread locknuts, made of tempered spring steel or Duronze. They apply on top of regular nuts and require only 3 bolt threads space. May be removed and reused. PALNUTS have proved their unfailing security through years of use on steel towers, wood pole lines, fittings, connectors, disconnects, transformers and other electrical and mechanical assemblies.

Double Locking Action



When the PALNUT is wrench-tightened, its arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt threads and downward on the regular nut (A-A), securely locking both.

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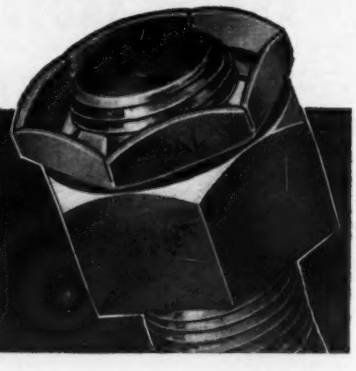

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Sales Opportunities

WASHINGTON—U. S. District Engineer Office, 1516 Elliott Ave., West, Seattle, has completed plans and will award contract soon for an electrical distribution system with service facilities for a signal corps installation at an army base.

WISCONSIN — Ladish Drop Forge Co., Cudahy, manufacturer of automotive and other heavy forgings, will carry out expansion in a plant for production for government, including new buildings, with mechanical and electrical equipment. Cost estimated about $800,000, with financing by Defense Plant Corp. Proposed to begin work soon.

NEW JERSEY—Navy Department, Washington, D. C., plans large ordnance depot on 11,000-acre tract of land, to include warehouses, shops and other structures, with mechanical and electrical facilities. A power substation is planned with electrical distribution lines. Property has water frontage, and a pier will be constructed, about 10,500 ft. long, with special railroad line and transportation system. New depot will be used primarily for storage and distribution, and is estimated to cost approximately $12,000,000. Work will be placed under way at early date.

CONNECTICUT — United Aircraft Corp., East Hartford, plans expansion in plant for production for government, including several new buildings and installation of mechanical and electrical equipment. Entire project will cost about $2,250,000, with financing by Defense Plant Corp. Work will proceed soon.

IDAHO—Swan Falls Power Co., Murphy, plans early rebuilding of hydro-electric power plant recently damaged by flood waters caused by collapse of Sinker Creek Dam, a 70-ft. high earth structure. Generators were under water and other damage developed. No estimate of loss has been announced.

LOUISIANA—U. S. District Engineer Office, Little Rock, Ark., has approved plans for extensions in airport, including shops and other structures, with mechanical and electrical equipment. Cost estimated close to $500,000. Work is scheduled to begin at once.

CALIFORNIA — Bureau of Reclamation, Denver, Colo., receives bids until July 26 for one 80-ton and one 40-ton gantry cranes for raising, lowering and transporting gates on upstream face of Friant dam, Friant Division, Central Valley project. Cranes will be installed by government. (Specifications 1055).

KENTUCKY—Ashland Oil & Refining Co., Ashland, will carry out expansion in plant for production of high-octane gasoline for government, including new processing and production units, with auxiliary structures. Cost estimated about $2,500,000, with financing by Defense Plant Corp.

OKLAHOMA — Navy Department, Washington, D. C., has authorized expansion in naval base, including shops and training buildings, administration building and other structures, with mechanical and electrical equipment and facilities. Cost estimated about $660,000. Work will be carried out at early date under direction of Bureau of Yards and Docks, Navy Department, Washington, commanding officer at Clinton, Okla., in charge.

TEXAS—Veterans' Administration, Construction Division, Washington, D. C., has recalled recent invitation for bids to close July 20, for pumping machinery and auxiliary equipment for institution at Amarillo.

ARIZONA — Christmas Copper Corp., Christmas, plans expansion in mining properties and mill, with installation of electrical and mechanical equipment for increased output. Cost estimated about $250,000. A priority rating has been secured and work will proceed soon.

ILLINOIS—War Department, Washington, D. C., will begin work soon on new army general hospital, comprising a group of one and two-story buildings, about 30 in all, with electrical and mechanical facilities. Also, outdoor distribution system with power substation; refrigerating plant and system; automatic fire alarm system, etc. Entire project will cost about $5,000,000 and will be carried out under direction of U. S. District Engineer Office, 222 North Bank Dr., Chicago, which will soon make award for general construction.

NORTH CAROLINA—Fairchild Engine & Airplane Corp., Hagerstown, Md., will carry out expansion in a plant for production for government, including new building and installation of mechanical and electrical equipment. Cost estimated about $400,000, with financing by Defense Plant Corp. Work will begin soon.

FLORIDA—Light and Water Department, Lakeland, has plans for new power substation for connection with transmission system of Tampa Electric Co., Tampa, which will furnish part of local power requirements in future. Financing has been arranged through federal aid and work will begin soon.

MICHIGAN—Ford Motor Co., Dearborn, has contracted with government for expansion in two plants with installation of mechanical and electrical equipment for increased output, estimated to cost $500,000 and $200,000, respectively. Work will be carried out at once. Financing by Defense Plant Corp.

MONTANA — Water Department, Shelby, plans installation of motor-driven pumping machinery and auxiliary equipment, controls, etc., in connection with proposed new municipal water system, to replace present facilities. Cost estimated about $100,000. Surveys are under way. Corwin & Co., Great Falls, are consulting engineers.

MINNESOTA—Northern Pump Co., Minneapolis, plans expansion in ordnance plant for production for government, comprising a main one-story building, about 300,000 sq. ft. of floor space, for manufacturing service, and another large structure for storage and distribution. Cost about $5,000,000 with mechanical and electrical equipment. Work will proceed at once. Financing by Defense Plant Corp.

FLORIDA—Florida Dehydration Co., Zellwood, and Zellwood Farms Co., same place, affiliated organizations, plan expansion program to include addition of dehydration plant, new ice-manufacturing and precooling plant, new one-story canning plant and miscellaneous structures, with installation of electrical and mechanical equipment. A priority rating will be secured. Cost estimated close to $500,000.

IDAHO—Navy Department, Washington, D. C., plans large one-story machine shop and warehouse at naval base, with machinery and electrical equipment. Cost about $1,000,000, with equipment. Work will be carried out by Bureau of Yards and Docks, Washington, D. C.

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Recent Rate Rulings

STATEN ISLAND EDISON CORP. has been ordered by the New York State Public Service Commission to make a temporary rate reduction of 8 percent on all bills for electric service. The total savings to consumers under the order, the commission said, would amount to $230,000 a year. The temporary rates are to remain in effect pending conclusion of a proceeding now in progress before the commission for the determination of the original cost of the company's properties.

EDISON LIGHT & POWER CO.'s compromise agreement with the Pennsylvania Public Utility Commission accepted by the board recently, calls for a final $30,000 in refunds to consumers. The commission, which at the same time removed restrictions freezing dividend payments since May 23, 1939, said that as a result of the commission's rate case instituted in 1937, Edison consumers had received $625,000 in refunds.

MONTREAL LIGHT, HEAT & POWER, CONSOLIDATED, terminated its long disagreement with the City of Montreal with regard to the rates to be paid by the city to the company for power for lighting streets and various other uses, when the city executive committee recently adopted a resolution agreeing to accept an offer made by the company in settlement. The company's offer is twofold; first, that the city shall retain, and the company abandon, all claims to $600,000 which the city has withheld during the two years from 1941 to 1943 on condition that this money shall be earmarked for the modernization of the city's street lighting system; secondly, that the Public Service Board shall set up a new tariff of charges to be paid by the city for power for street lighting. This problem arose when war conditions prevented the city from modernizing its street lighting system, as required by a law adopted some years ago in Quebec. This law required the company to make a reduction in its charges of $300,000 a year for two years, and thereafter to establish a new tariff, which could imply at least that amount of reduction in the annual bill. It required the city, however, during the two-year period, to remodel its lighting system entirely. When the two-year period ended, the Public Service Board issued an order, fixing a complete list of charges to be allowed the company. The company appealed this decision and the Appeal Court upheld the company. The acceptance by the city of the company's subsequent offer is expected to end the dispute.

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needs Seed Money most of all

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But all of the people in every manufacturing center in the United States should be getting these or comparable messages.

We will gladly furnish you a free mat if you want to join the many companies who are doing a basic public relations job by running this Seed Money series in their local newspapers.

James H. McGraw, Jr.
President
McGraw-Hill Publishing Company, Inc.

ONE of the easiest things for you to understand, and one of the hardest things for government to understand is "Little Business."

Little Business lives right around the corner from you . . . He's the garage man who has pooled his lathe with the lathes of other garage men and opened a factory to turn out war materials . . . He's the machinist who has scraped up some second-hand equipment, hired some other machinists and turned an empty building into a source for bomb-rack parts . . . He's the boat yard owner who has parlayed a little knowledge and a lot of guts into a fleet of subchasers . . . Maybe he is one of the 21,000 sub-contractors who are helping just one large manufacturer (International Harvester Co.) fulfill his war contract.

Everybody knows Little Business because everybody meets businessmen everywhere they go.

Three cheers for Little Business, because—through courage, resourcefulness, and unlimited hours of work, businessmen are helping to win this war.

But, before you join in the cheers, take thought of what we said in the first paragraph: it is hard for *government* to understand Little Business.

You can do something more effective for Little Business than giving him the empty reward of your applause.

You can help him survive when the war is over.

And don't think it is not VITAL to you that the millions of hustling, adventurous souls who constitute the army of "Little Business" do survive.

The "take a chance" spirit of businessmen is the spark that has made America a great nation.

► Every time a businessman succeeds he makes jobs for other men and women. Every time that happens

FREE MATS: If you would like to publish this message over your own company name, or distribute it in handy booklet form, write or wire: Research Dept., McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York (18), N.Y.

"LITTLE BUSINESS" needs Seed Money most of all (cont'd)

there is more real wealth available for Americans. Multiply that by the millions of Little Businessmen and it's easy to see why it is vital that they survive.

Bear in mind that we haven't said government doesn't want Little Business to survive. Government loves Little Business. All government people get a tender light in their eyes when they speak of the Little Businessman.

But government is handicapped. It wants to help the Little Businessman, but it doesn't know how, because it does not understand the motives and rewards of business adventure.

Business is "profit-minded." That's why it is so hard for government to understand it.

Government should try to understand the profit-motive, because out of profit comes the Seed Money that creates still more jobs. Businessmen lay aside a part of their profits to be used for future development. This is called Seed Money.

Seed Money is not personal profit. It is used to develop new methods and to buy new machines that do more work in less time. These improved machines make higher wages and lower prices possible. In turn, improved machines yield still more Seed Money and the process grows in an ever widening circle. We call the result a "high standard of living."

▶ With this wonderful, automatic encourager of human endeavor (profit) at its command, wouldn't you think government would say "Swell, here's the device that will make jobs for everybody after the war, pay off the war debt and raise our standard of living still higher. Let's put Seed Money to work harder than ever before."

Does government say this? No, you know it doesn't. Instead, Government regards business profit merely as a source of tax money. It withers progress and improvement for all Americans by draining off the business profits that would create new jobs when the war is over.

Little Business is hit hardest of all.

Generally, a small business has no record of high profits in the years before the war. Therefore, in the eyes of government, most of the profits such a company makes is "Excess Profit" and is taken away in taxes.

What will Little Business do when the war is over? Will he hire his share of returning soldiers, and out-of-work government people, as well as keep the people who are working for him now?

To do that, he will need the best machinery; he must pay for improvement of his products, and finance the distribution and sale of those products.

He'll have the brains and courage for all that, but he won't have the money.

But there are millions of Little Businessmen. They will get together. They and their friends will bombard Congress. Another government bureau will be set up.

▶ Government money will be loaned. But a funny thing will happen. Little Business will not be free to "take a chance" with this money, because it belongs to the government. But "taking a chance" is the life breath of all business, especially Little Business. There will be a penalty on courage.

You, dear reader, whether you are a bureaucrat, business or professional man, farmer or laborer, can't afford to let that happen to the venturesome business spirit that sustains our national life.

You can do something about it, too. You can help spread the knowledge everywhere that production in war and good living in peace depend upon healthy, constantly improving business and industry. You can be against monopoly and still know that Big Business really exists to serve the millions of men who are Little Business, and depends upon them for its own existence.

You can believe in social reform, and still see that it's one thing to kill the weeds in our Industrial Victory Garden and another to attack the crop.

You can tell your Congressman that the most practical post-war planning he can do is to help in framing laws that will create a favorable environment for business in the post-war world.

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is the Source of all Good Living."

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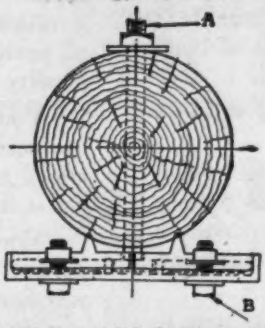
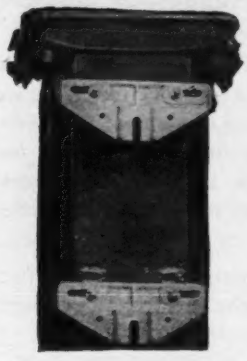
Transformer Conversion Mounting

Transformers now hung direct on poles on through-bolts must be replaced occasionally—and sometimes with transformers on hand equipped with suspension hangers requiring installation of crossarm, or double crossarm, or a conversion adapter for through-bolt mounting.

M.I.F. Conversion Mounting Plates have solved this problem for approx. 10,000 transformer conversion installations. The PT2 Plate for transformers with ½" or ⅝" lug-bolts spaced horizontally up to 7¾" (including most 15 kva. and some 25 kva.) is illustrated (top), showing the positive retainer for through-bolt head.

The sketch immediately below shows Plate attached to pole with through-bolt "A", with lug-bolts "B" for attachment to transformer. In practice, Plates are bolted to transformers as shown in bottom illustration before hoisting same up the pole. Note the firm grip on pole of two vertical triangular ribs. Such an installation is simple, rugged and effective generally.





Prices: PT2 Plate, galv., 63c ea., F.O.B. Branford. Shipping weight 360 lbs./C. PT3 Plate for transformers with horizontal spacing from 7⅛" to 12⅜", $1.26 ea. Shipping weight 800 lbs./C. Available ungalvanized, if preferred, at 50c and $1.00, resp. Lug-bolts extra.

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LETTERS TO THE EDITOR

Farm Dehydrator

To the Editor of ELECTRICAL WORLD:

In the May 1 issue there is an article under "Load Service" describing a dehydrator which can be built *entirely*, according to the author, of non-priority materials.

Some of the materials listed are: Plywood, ⅛-in. hardware cloth, and an electric fan.

Just try to buy any of them.

C. F. Ross,
Waltham, Mass.

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Lumens, Not Foot-lamberts

To the Editor of ELECTRICAL WORLD:

The writer, having spent more than a year making lighting investigations (for the Board of Transportation) relative to blackout and dimout illumination, feels qualified to comment on your editorial of June 12, 1943, in the ELECTRICAL WORLD entitled "Lumens, Not Foot-lamberts."

To the best of my knowledge, sky-glow results from stray light which is reflected and refracted by the dust and moisture in the atmosphere, and is thus scattered in all directions to form the characteristic "glow." The measure of the contribution of any reflecting surface to this glow is obviously its brightness, not the intensity of the incident light flux.

Any light source which contributes directly to the sky-glow should, of course, be evaluated in terms of the actual number of lumens above the horizontal coming from this source. However, in keeping with present regulations, no light source in this area should make such contribution, since all are required to be shielded against this very condition.

The "criminal" is, therefore, light reflected from non-vertical surfaces, and from surfaces at any inclination which produce diffused reflection.

It seems to me that the brightness, viewed from any angle, should not exceed the values specified in the regulations. Since brightness is a function of the surface as well as the incident light flux, it would seem possible to exercise control in two ways:

1. Control of intensity of incident illumination through control of light

source and/or space between light source and reflecting surface.

2. Control of brightness of reflecting surface by proper treatment to reduce its reflectivity to a value such that the regulations will not be violated.

I trust that the most recent regulations (which I have not seen) are broad enough to include all exposed surfaces, for any exposed surface may be an offender.

The foregoing is offered sincerely, in the hope that it may prove of value in interpreting the regulations.

HERBERT EDELSTEIN, P.E.
New York, N. Y.

To the Editor of ELECTRICAL WORLD:

Your editorial in the June 12, 1943, issue of ELECTRICAL WORLD entitled "Lumens, Not Foot-lamberts" is the most interesting and hits the nail on the head. The trouble is that for the last twenty years illuminating engineers have been tieing up glare with brightness.

In the "American Recommended Practice of Industrial Lighting" approved March 17, 1942, by the American Standards Association and prepared by the Illuminating Engineering Society, page 18 states: "Glare may be defined as any brightness within the field of vision of such character as to cause discomfort, annoyance, interference with vision or eye fatigue." Also, "Direct glare is caused by excessive brightness or brightness-contrast within the visual field." Also, "Reflected glare is caused by high brightness, etc." If the Illuminating Engineering Society does not know what it is talking about, how can we expect the Army engineers who draw up the dimout regulations to know anything different?

In the last issue of "Light," a copy of "Analysis of Typical Industrial Lighting Systems" was included, and I was agreeably surprised to see that Nela Park admits that flux of light and not brightness produces glare. It states: "In the first place few people realize that the glare due to specular reflection decreases with the height or distance of the light source from the specularly reflecting surface. It appears as though the effect of reflected glare may vary inversely as the square of the mounting height." This is just a long way to say glare is caused by flux of light.

Brightness is a ratio (lumens per square foot or candlepower per square inch, etc.). A ratio is a mathematical conception and not a physical one. A ratio must be multiplied by the total of the denominator to convert it into a physical thing, instead of a mathematical term, before it can be capable of doing anything; *e.g.*, ten horses per

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Broad, strong head, with size plainly marked. Sides of head have flat surface so wrench or pliers can grip tightly.

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"V" shaped groove, holds wires in three point contact and prevents rocking or looseness.

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To the Editor of ELECTRICAL WORLD:

The revised dimout regulations put out by the First Service Command and referred to in one of your editorials in the June 12 issue of ELECTRICAL WORLD were prepared with the assistance of an I.E.S. committee. This committee included myself as chairman; C. I. Dwinell, secretary of the New England Section, I.E.S., and senior engineer for the New England Region of O.C.D.; A. S. Walker, member of the A.I.E.E. and chairman of the State of Massachusetts Blackout Committee; R. E. Simpson, blackout consultant, Connecticut Defense Council, and R. W. Hobson, executive officer of the State of Maine Defense Council.

You undoubtedly know that the original studies of sky-glow and the analysis of its causes were made by the Massachusetts Committee on Public Safety at the request of the First Service Command. Last fall a brief article on this subject appeared in ELECTRICAL WORLD. I cite this to indicate to you that members of the above-mentioned committee are exceptionally well informed on the causes of sky-glow and in addition have had considerable experience in the administration and enforcement of dimout regulations. Any dimout regulations that are made, however, must take into account the practical aspects as well as the technical aspects of the problem.

These new regulations have also been reviewed by the defense councils of all the New England states, the various state legal departments, the Regional Director of O.C.D., the commanding general of the First Service Command, and also the staff of the Eastern Defense Command. All of these people understand the meaning of the present regulations, including the point raised in your editorial, which is quite an accomplishment. Some of this accomplishment is undoubtedly due to the fact that we changed as little as possible in the regulations in order to meet the conditions imposed by the Army. Had we started from scratch and scrapped everything that had been done in the way of dimout regulations over the past year, we would have quite a different set of rules, but we conceded the point that the Civilian Defense Organization should not be required to start all over again and magnify the confusion that much more.

Since last November, for example, factory windows and other openings have been required to be screened with curtains, paints, or other material, and the foot-lambert classification was designed to control the degree of screening required. This, I must insist, is a perfectly sound and logical specification. It also has a practical advantage in that you can stand away from a building and with a brightness meter read the average brightness of a whole series of windows or perhaps the entire side of a building. Obviously, a large factory will produce more sky-glow than a small one, but it seemed only fair to require all factories to pull down the brightness of their windows to the same level. I must admit that the foot-lambert specification is not particularly sound for unscreened windows, but the fact is we have no such windows at the present time due to the prior rule having been in effect since November. We expect to cross this bridge when we come to it, either with a foot-candle specification of some sort or by controlling the cut-off of light so that no direct light from the fixtures will fall on the window area, or both methods.

Finally, you will be interested to know that the foot-lambert specification for factory windows appears in the "Proposed Interim Dimout Regulation" issued jointly by the Army Engineer Board and the United States Navy. Whether they borrowed this from New England practice or arrived at it independently I have no way of knowing. This document is in the hands of all service commanders and O.C.D. blackout specialists as a model to be followed in writing future regulations.

R. B. BROWN, Jr., President,
Illuminating Engineering Society.

•

Elevation, Not Height

To the Editor of ELECTRICAL WORLD:

The ELECTRICAL WORLD, issue of June 12, 1943, page 87, has an article about the effect of the Grand River Dam (Pensacola, Okla.) on the flood conditions at points downstream.

Among the statements one reads: "The dam is 755 feet high."

Since this exceeds, as the writer recollects, the height of the Boulder Dam, it is obviously incorrect. The article itself contains statements about various elevations all 750, etc., feet, which are probably based on some sea level datum.

In any event, from personal observation, the dam itself is not "755 feet high."

C. O. VON DANNENBERG,
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(Continued on the following page)

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1—200 HP, 450 RPM, 2200/4000 v. G. E., sl. rg.
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1—250 HP, 760 RPM, Electro Dynamic.
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1—125 HP, 600 RPM, Westinghouse, SK.
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1—100 HP, 635 RPM, G.E.
1— 65 HP, 1000 RPM, G.E., type RC.
1— 50 HP, RPM, Westinghouse, type SK.

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3—200 KVA, G.E., 2200-220/440 volts.
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3—100 KVA, Westinghouse, 11,430/250 volts.
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1—35 HP, 500/15000 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electric Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—13/18 HP, 350/1200 RPM, Electro Dynamic
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP,450/1800 RPM, Crocker Wheeler.

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1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
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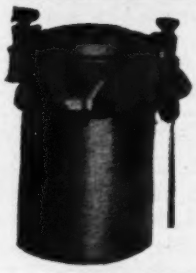

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1—	1250	G.E.	MPC	550	130
1—	800	G.E.	MPC	660	600
1—	625	G.E.	MPC	600	130
1—	600	G.E.	MPC	600	650/900
1—	600	Whse.		250	150/275
1—	350	G.E.	MPC	230	450
1—	300	G.E.	DMC	230	400/600
1—	300	Cr. Wh.	CMC	230	1150
1—	300	G.E.	MPC	230	275/550
1—	270	Whse.		500	250/400
1—	250	Al. Ch.		230	525
1—	200	Whse.		230	400
1—	175	Whse.	SK	250	150/525
1—	150	G.E.	RC-19A	230	800/1000
1—	150	Whse.	SK-201	230	300/900
1—	150	G.E.	MPC	230	250/450
1—	125	G.E.	CO-1832	230	625
1—	120	Whse.	SK-180	230	720
1—	100	G.E.	LC-50	230	1200
1—	100	Al. Ch.		230	950/1150
1—	100	G.E.	RC-19	230	575/720
1—	75	G.E.	LC	230	500/1000
1—	75	Whse.	SK	230	475/900
1—	60	El. Dy.	258	230	525/1050
1—	50/60	Cr. Wh.	65H	230	500/1000
1—	50	G.E.	RC-16	230	650/815

TRANSFORMERS

	KVA	Make	PH	Type	Voltages
1—	100	Pitts.	1	OIS	2 00/4600x575
1—	100	G.E.	1	HKDD	13800x2300
1—	300	G.E.	1	H	13200x2300/575
1—	200	Whse.	1	SK	6900x230/460
1—	200	G.E.	1	H	26400x115/460
1—	100	Whse.	1	OISC	13200x250

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3 ph. 60 cycle

Synchronous

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1—	500	G.E.	TS	440	360
1—	250	G.E.	ATI	220	450
1—	225	G.E.	ATI	240	600
1—	200	Whse.		440	514
1—	150	G.E.	TRB	220x440	450
1—	150	Whse.	G	2300	900
1—	150	Whse.		2200/550	1800
1—	125	G.E.	ATI	240	257

Slip Ring

1—	800	Al. Ch.		440	885
1—	600	G.E.	IM	2200	900
1—	450	Whse.	CW	2200	875
1—	400	G.E.	MT	550/440	300
1—	400	Al. Ch.		2300	505
1—	400	Al. Ch.		440	1200
1—	350	G.E.	IM	2300/4000	257
1—	300	G.E.	IM	2300	585
1—	250	G.E.	MT-410	2300	400
1—	250	G.E.	MT	4000/2300	257
2—	200	Whse.	CW	2200	514

Squirrel Cage

1—	500	G.E.	1-17B	2200	695
1—	300	Whse.	CS	550	580
2—	300	G.E.	1K	2300	600
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1—	250	Al Ch.		220/440	1150

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★ These companies have supplied additional buying information on their products in the 1943 edition of the Electrical Buyers' Reference

When a Switchboard has all these

Installation view of 440-volt, withdrawal-type Multumite switchboard with overhead, enclosed bus designed and fabricated by I-T-E. Length 64 feet, housing 52 circuit breakers.

WELDED STEEL FRAME
—a rigid steel structure for strength and alignment.

FLANGED DOORS
—formed and welded into sturdy members. Panels at sides, top and back are made the same way.

GRILLE-TYPE LOUVERS
—for better ventilation per square inch of opening.

BONDERIZED STEEL
—metal treated so that finish withstands severe service without cracking or peeling.

12 FINISHING OPERATIONS
—cleaning, spray-priming, then baking; then two sprays and two bakes. Pneumatic sanding prepares for two coats of enamel, both baked.

SELF-ALIGNING SEPARABLE CONTACTS
—for dependable service with least loss. No springs in current path; no pig-tails.

ROTARY-TYPE HANDLES
—for fast safe operation of enclosed circuit breakers.

CONCEALED HINGES
—offering 100-degree opening of doors.

...it's MULTUMITE

Design and construction features characteristic of Multumite air switchgear are incorporated as standard I-T-E practices.

I-T-E manufacturing is set up to perform all the operations with the skill and speed that standard practices bring with them.

Careful planning of processing and assembly operations enables I-T-E to build air switchgear at the speed required under the pressure of war needs without omitting any of the Multumite features.

I-T-E

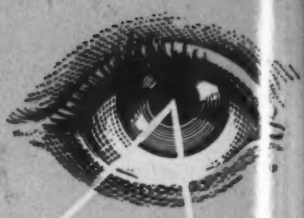
AIR SWITCHGEAR

IMMERSED IN AIR • ENCASED IN STEEL

I-T-E

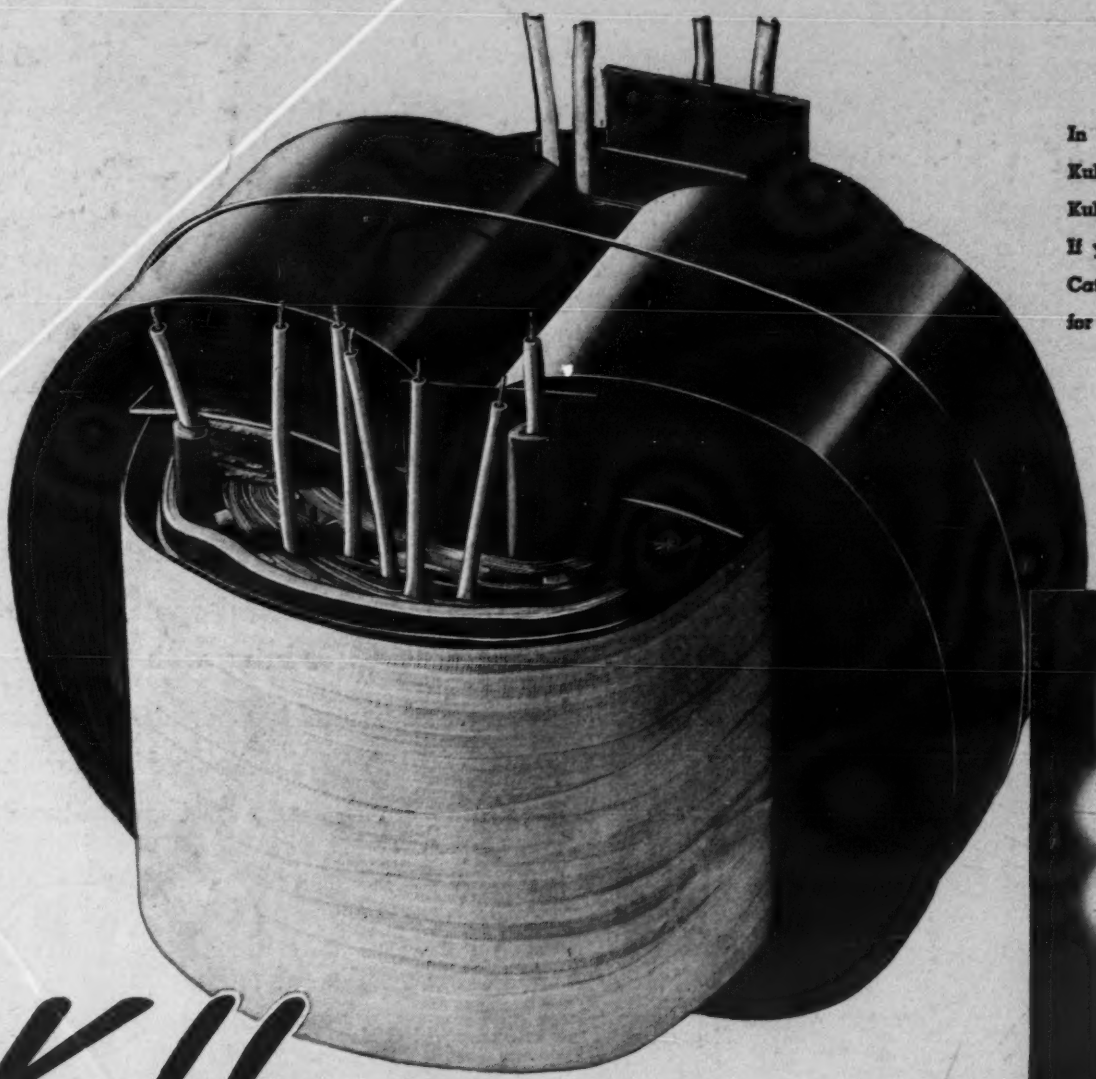
Representatives in Principal Cities

CIRCUIT BREAKER CO., PHILADELPHIA, PA.

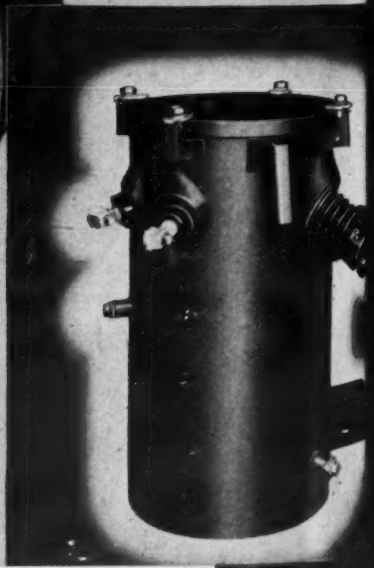


Let's look again at this Kuhlman B. I. Co[illegible]e

Conceived, developed, perfected and first introduced by the Kuhlman Electric Co. the [illegible]ent Iron (B.I.) Core utilizes to the fullest extent the many advantages inherent in present day materials. The result is reduced exciting current, general improvement of operating characteristics, a lighter, easier-to-handle transformer and a considerable saving of two critical metals—iron and copper. As compared with former conventional core and coil methods, the Kuhlman B. I. construction saved enough iron for the building of fifteen medium tanks and enough copper for three million .50 calibre shells in the Kuhlman plant alone, in one year. Multiply this many times and you get an idea of the metal saving in the transformer industry—metal for conversion to tanks, bullets, guns and other fighting equipment for the fighting men of the Allied Nations.



In addition to distribution transfor[illegible] Kuhlman builds Power, C.S.P., [illegible] Kuhl transformers and line regula[illegible] If you do not now have the Kuhl[illegible] Catalogs describing these units, [illegible] for your copies today.



Kuhlman ELECTRIC COMPANY
BAY CITY, MICHIGAN